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A
S Y S T E M
OF
S U R G E R Y:

BY
✓
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A
SYSTEM
OF
SURGERY.

CHAPTER XXIII.

OF HERNIÆ.

SECTION II.

Of the Bubonocèle.

CONJOINED with the general symptoms of hernia enumerated in the last section, the particular appearances of the bubonocèle, or inguinal hernia, are, a soft somewhat elastic tumor, beginning in the groin, and descending by degrees into the scrotum in men, and labia pudendi in women. When a portion of gut forms the disease, the tumor is commonly tense in proportion to the degree of stricture in the opening of the tendon; and when the parts inflame, handling or pressure always gives pain.

When it contains omentum only, the tumor is both more soft, compressible, and more unequal, than when gut alone is down; the scrotum becomes more oblong than in an intestinal hernia; and when the quantity of omentum is large, it is also much more weigh-

ty than a gut rupture of the same size: but in a great proportion of cases, the tumor is composed both of gut and omentum: in this case the distinguishing symptoms of each can never be so clearly marked. Various symptoms indeed are enumerated by authors for distinguishing the contents of *herniæ*; but whenever the case is complicated, every candid practitioner will admit, that no certainty can be obtained of this till the tumor is laid open.

As these parts are liable to other tumors with which the inguinal and scrotal hernia may be confounded, practitioners should be as much as possible acquainted with the marks of distinction. These tumors are, glandular or other swellings in the groin, whether from the venereal disease or any other cause; that swelling of the testis termed *hernia humoralis*; and the different varieties of hydrocele.

The venereal bubo and other glandular tumors in the groin, are distinguished from hernia, not only by their wanting all the general symptoms of hernia, but by that incompressible hardness with which glandular swellings are at first attended, and by the fluctuation of matter which in their suppurated state is observable.

In the *hernia humoralis*, the hardened and enlarged state of the testicle; its being exquisitely painful to the touch; remarkably heavy in proportion to its bulk; and the spermatic process being commonly free from swelling; may be considered as certain marks of distinction. In the *hernia humoralis*, too, the intestines are free and unobstructed, and the other general symptoms of hernia are wanting.

In the hydrocele of the *tunica vaginalis testis*, the tumor in general is more equal than in hernia: in the former, it begins in the under part of the scrotum, and proceeds upwards; whereas the reverse occurs in hernia. In hydrocele the spermatic cord is in most instances distinctly felt, whereas in hernia where the tumor descends to the scrotum, the spermatic cord cannot in any part of its course be distinguished. In

hydrocele, the fluctuation of a fluid is distinguishable ; in hernia it is not.

From the anasarcaous swelling of the scrotum, or hydrocele of the dartos as it is termed, hernia is easily distinguished ; and indeed the means of distinction are so obvious, that they need not be enumerated ; but there is another variety of hydrocele, the hydrocele of the spermatic cord, which in some instances it is difficult to distinguish from hernia, and which therefore requires particular attention.

Where the water is collected in one or more cells of the spermatic process, and begins in the under part of the cord, and proceeds upwards, this alone serves as sufficient means of distinction between it and hernia, in which the swelling must always proceed from above downwards ; but it sometimes happens, that the water begins to collect even within the opening of the abdominal muscle, and by degrees falls downwards. In this case we cannot determine from the state of the tumor alone, whether it is the one disease or the other. The general symptoms of hernia, such as pain and tension of the abdomen, vomiting, and obstructed intestines, must be kept in view ; for not being connected with hydrocele, they serve to ascertain the nature of the case, in which their absence might long remain doubtful. In some cases, however, these and every other means of distinction are wanting ; but even in such circumstances a practitioner of experience will never incur the risk either of hurting his patient, or his own reputation, which the mistaking a hernia for a hydrocele, and treating it as such, must always do, and which, to the disgrace of surgery has in some instances been done.

In all such cases of doubt, as well as in every tumor of the testicle where the most perfect certainty is not obtained, and in which an operation becomes necessary, the surgeon should proceed as he would do in hernia : by doing so, every risk will be avoided : on

the tumor being laid open, the true nature of the disease will become evident, and the practitioner will be at liberty to apply the means best suited for the cure. Whereas in proceeding differently as in some cases has been done, and treating as a hydrocele what afterwards proves to be hernia, he not only incurs the risk of injuring his own reputation, but of destroying his patient.

In the treatment of the bubonocoele, when the means pointed out in the last section as applicable to every state of hernia do not succeed, we are then under the necessity of proceeding to the operation; and the method of doing it is this:

A table of a convenient height being fixed in a proper light, the patient must be placed upon it with his head and body almost horizontal, whilst his buttocks are raised with pillows beneath them. The legs hanging over the edge of the table must be separated so as to admit the operator between them; and should in this situation be firmly secured by an assistant on each side, who should take care at the same time to keep the thighs so far raised as to relax the abdominal muscles.

That we may obtain as much empty space as possible for returning the protruded parts, the patient should be advised to empty his bladder; and the parts having been previously shaved, an incision must now be made with a scalpel through the skin and part of the cellular substance, beginning an inch above the superior end of the tumor, and proceeding down to the most depending part of the scrotum. Even where the tumor does not reach to the bottom of the scrotum, the parts should be laid open in this manner. By a free external incision, we are enabled to finish the operation with more ease than when the first opening is small: it does not give much more pain; and being continued to the bottom of the scrotum, the matter in the upper part of the fore is prevented from collecting below, which otherwise it is ready to do.

The operator must now proceed to divide the rest of the cellular substance covering the sac; and even this should be done with caution: for although in a great proportion of cases, the spermatic vessels lie behind the protruded parts, yet occasionally they are found on the anterior part of the tumor; so that in order to avoid the risk of wounding them, as soon as the skin is divided, the remainder of the operation should be conducted with much attention, care being taken to avoid every large blood vessel that makes its appearance.

This circumstance of the prolapsed parts getting down behind the spermatic vessels, has never, so far as I know, been mentioned by authors: it must therefore be a rare occurrence. As I met with it, however, in one case, where the fact was obvious, the possibility of its happening I have no reason to doubt. If we attend only to the usual conformation of these parts, the hernial sac, we would say, ought never to get behind the spermatic cord: but we know well, that in no part of the human body is nature more apt to desert her ordinary course, than in some circumstances relating to the testes and their blood vessels. I have already observed, that till near the period of delivery, the testicles continue in the abdomen; and about this time, that they fall down in a gradual manner to the scrotum. Many instances, however, occur, of both testes remaining in the abdomen through life; while sometimes one remains, and the other falls into the scrotum. In others, one or both fall into the groin, and never proceed farther; a circumstance which young practitioners should be aware of, as instances have occurred of a testicle resting in the groin being mistaken for a hernia, and of much pain being excited by attempts made for reducing them. Now, if we frequently meet with such varieties as this in the mechanism of these parts, why may not nature sometimes produce such a conformation as, on a hernial sac falling into the scrotum, may place it behind both the

spermatic cord and the testicle? And as I have shewn that it has happened, and as it may therefore occur again, I consider it as a farther argument for the propriety of dividing the parts in the cautious manner I have mentioned.*

It is usual, in making the first incision, to pinch up the teguments, and then to divide them with a scalpel; but no surgeon of steadiness and dexterity will ever proceed in this manner. This incision of the skin is done with much more neatness, and with equal safety, by the operator grasping the tumor with his left hand, in such a manner as to render the teguments on the anterior part of it tense, while, with the scalpel in his right hand, he divides the skin from one end to the other.

The sac being laid bare, an opening must be made in it, so as to bring its contents into view; and the most safe place for this being formed, is, not about the middle of the tumor, as is commonly directed, but as near to the under point of it as possible: it is here done with the same ease as in any other part; and besides, the gut is seldom found just at the bottom of the sac, which is commonly occupied with a quantity of bloody serum; so that the risk of wounding it in this situation, is less than in any other part of the tumor. In making this perforation of the sac, consists the greatest nicety in the operation, the utmost caution being necessary to avoid the parts which it contains. Good eyes and a steady hand are in no operation more requisite than in this: with these, any practitioner acquainted with the anatomy of the parts, will do the operation properly, and without them the best anatomist must go wrong.

With the same scalpel that divided the skin and cellular substance, the operator must proceed slowly, di-

* Since this went to the press, I find that an instance is recorded by Le Dran, in his *Treatise of Ruptures*, of the spermatic vessels having been found on the anterior part of a bubonocoele. This situation, therefore, of these vessels, is perhaps more frequent than is commonly imagined.

viding one fibre of the sac after another, till an opening is formed in it ; which may be always discovered with the blunt end of a probe : if the probe passes in easily, we may conclude with certainty that the sac is divided ; and if it does not, the incision must be continued in the same gradual manner somewhat deeper, when the same trial with the probe must be repeated.

In prosecuting this division of the sac, we derive much advantage from the use of a small sharp pointed directory, open at the extremity, as is represented in Plate LXVI. fig. 3. By pushing the end of it below some of the fibres of the sac, they are easily separated from the parts beneath, and may thus be divided with safety ; and in the same manner the rest of the sac must be divided, till this part of the operation is completed.*

In almost every hernia in the groin, and even where the tumor extends to the scrotum, if the parts are recently protruded, the hernial sac is thin, and therefore easily cut through ; but it is necessary for the information of young practitioners, to observe, that when hernia is of long duration, the sac frequently becomes so thick, as to require much more dissection than beginners commonly expect : by going on, however, with the caution I have directed, every risk of wounding any part of importance may be avoided.

As soon as an opening is made through the sac, a circumstance of which we become certain, as I re-

* In the 4th volume of Memoirs of the Paris Academy of Surgery, there is a paper on Herniæ, by Monsieur Louis. But although it contains many useful observations, Mr. Louis in one point I think has gone far wrong, in ridiculing that degree of caution which in dividing the hernial sac is unquestionably requisite : the division of the sac, he says, is attended with so little difficulty, that he does not consider it as different in that respect from the first external incision of the skin. His words are : “ Jamais le sac ne m’a donné ni plus de peine, ni plus d’embarras que la peau ; on divise, “ pour ainsi dire, celle-ci du *premier trait*, et le sac du *second*.” In the hands of a very expert operator, the scalpel, even in this manner, may be so managed as to do no harm ; but, in common practice, much mischief would be done by proceeding as Mr. Louis has directed. It might tend to show the dexterity of an operator, but this would always be at the hazard of the patient.

marked above, by a probe passing easily in, it ought then to be farther enlarged, by cutting upon the director, till it is of such a size as to admit the forefinger of the operator.

The forefinger of the left hand must now be introduced, and used as a director for entering the narrow blunt pointed bistoury, represented in Plate LXIV. fig. 2. with which the hernial sac must be divided along its whole length up to the opening in the external oblique muscle. With the finger used as a director for the bistoury, this part of the operation is performed with safety; and the bistoury here delineated, renders all the instruments formerly employed not only for this part of the operation, but for the subsequent division of the tendon, quite unnecessary.

On laying the sac open at the bottom, a quantity of coloured fluid commonly rushes out, and the protruded parts come fully in view: if a portion of gut is down, and not much entangled with omentum, by being now set at liberty, more of it comes instantly on the sac being opened; thereby giving the appearance of having been collected in a larger quantity than the size of the tumor gave reason to expect.

The portion of gut that we meet with in hernial swellings is various, no part of the intestinal canal being entirely exempted from falling down. Hitherto the ileum has been commonly supposed to form the substance of a great proportion of herniæ, but later and more accurate observation renders it probable that the cæcum, appendix vermiformis, and part of the colon, are perhaps as frequently contained in herniæ as any other portion of gut.

The sac being laid fully open, the parts contained in it should be examined with the nicest attention, in order to discover whether they are sound or not; and if upon attentive inspection they appear to be sound, that is, if they are not evidently in a state of gangrene, even although they seem to be inflamed, they should be immediately returned into the abdomen.

Whether intestine or omentum, or a portion of each, have been contained in the tumor, those parts of them which have come last down should be first pushed back, the difficulty and trouble of returning them being thereby much lessened: and in making the reduction, it both answers the purpose better, and is less likely to do harm, to apply the fingers to that part of the intestine connected with the mesentery than to the convex part of it. While the reduction is going on the patient's thighs and loins should be still more elevated than they were during the preceding steps of the operation; for this posture of these parts tends much to facilitate the return of the protruded intestines to the abdomen.

When the disease is recent, and the parts have not been frequently down, it sometimes happens, that by pulling out a little more of the gut, the difficulty that occurred to the reduction is thereby removed; and if the protruded parts are not of great magnitude, they may thus be sometimes reduced, without the opening being enlarged by which they passed from the abdomen: but when this cannot be done with ease, it should never be attempted; more danger being to be dreaded from force applied to the gut, than can ever occur from finishing the operation by enlarging the opening in the tendon of the external oblique muscle.

As the tendon of this muscle runs in an oblique direction from above downwards, and as the opening through which the contents of a hernia protrude, is formed by a separation of the tendinous fibres of the muscle from each other, the direction of this opening is of course the same with that of the tendon; that is, it runs somewhat obliquely from the spine of the ileum to the os pubis.

In enlarging this passage, then, for the reduction of the parts that have passed through it, as a transverse section of the tendon is not necessary, the knife should be carried obliquely upwards, so as merely to continue the natural separation of the tendinous fibres.

The finger was recommended as the best director for the knife in opening the sac, and in dividing the tendon it proves equally useful. By insinuating the finger into the aperture of the tendon immediately above the protruded parts, the point of the blunt bistoury, Plate LXIV. fig. 2. is easily introduced upon it; and in this manner, by keeping the end of the finger a little before the bistoury, the opening may be enlarged to any necessary extent without risk of wounding the contiguous parts.

In general, a very small enlargement of the natural opening in the tendon proves sufficient: but the size of the opening should be fully equal to the object in view; for it is better to make it somewhat too large, than to run any risk of hurting the gut by forcing it through a small aperture.

If on the introduction of the finger any adhesions of the gut to the contiguous parts are discovered, the incision in the tendon should be made larger than might otherwise be necessary, that the finger may be so freely admitted, as to destroy such adhesions as it can reach; for if not removed, the operation would very probably fail.

Besides these internal adhesions, it sometimes happens, by long confinement in the scrotum; pressure; and perhaps from other causes; that strong adhesions are formed among the parts contained in the sac: and before reducing them, it is always right to attempt to separate them.

When these adhesions occur, as they sometimes do, between different parts of the gut, they should be separated with much care; but connections of this kind between one portion of gut and another, are seldom firm, and are commonly easily separated: when formed by means of long filaments, which is sometimes the case, the easiest method of removing them is to cut them, either with scissars or a bistoury; but when one part of the gut adheres so firmly to another as not to be separated but with difficulty, it is much better to

return the whole even in this state to the abdomen, than to run the risk of hurting it by employing much force.

When, again, adhesions form between the gut and the hernial sac, or between the gut and omentum, if the filaments by which they are produced cannot be otherwise removed, as there is no great hazard in wounding the omentum, and still less from hurting the sac, a small portion of both may be dissected off, and returned with the gut to the abdomen; and in like manner, when the omentum adheres so firmly to the sac as not to be separated in any other manner, no danger can accrue from the sac being encroached on.

The risk attending this practice is trifling, when compared with the inconveniencies that would ensue from leaving either the omentum or gut adhering externally to the hernial sac, as is advised by some when these adhesions cannot be easily divided. The least portion of gut being left down, would run much risk of being injured by exposure at the different dressings; and by leaving part of the omentum to protrude through the opening from the abdomen, one advantage to be expected from the operation would be lost, namely, the prevention in future of that risk to which a patient with a portion of protruded omentum must be always liable, of a piece of gut slipping down, and perhaps of becoming strangulated.

After returning the contents of the sac into the abdomen, it has been proposed by some, to pass a ligature round the upper part of the sac just at its neck, with a view, as we are told, of procuring a reunion of its sides, in order that it may serve as a means of preventing future descents of the bowels.

But as a ligature cannot be applied in this manner without risk of injuring, or even of destroying the spermatic vessels, with which the posterior part of the sac is immediately connected, the practice, from this consideration alone, should be laid aside; but in reality it does not appear to be necessary, as this very union of

the sides of the sac is always produced merely by that degree of inflammation which succeeds to the operation.

Hitherto I have advised the contents of herniæ to be immediately reduced, on the supposition that they have been only displaced ; that they have been adhering to each other or to the neighbouring parts ; or perhaps that they have been more or less in a state of inflammation. But when it appears that this inflammation has already ended in gangrene, as the return of mortified parts, whether omentum or intestine, might be attended with hazard, more caution is required.

When the omentum is found in a state of mortification, as a portion of it may be removed without much risk, it has been the common practice to cut off the diseased parts ; and in order to obviate any inconvenience from the hemorrhagy that might ensue, we are advised to make a ligature on the sound parts previous to the removal of those that are mortified ; while, by leaving the ends of the ligature hanging out of the wound, the surgeon has it in his power to remove it whenever he may think fit.

Ligatures on the omentum, however, having frequently induced bad symptoms, such as nausea, vomiting, cough, fever, pains in the belly, and inability to sit erect ; and as we now from experience know, that no hemorrhagy of importance ever occurs from its being divided, such parts as have become gangrenous may therefore be freely cut off, and the remaining sound parts be introduced into the abdomen, without ligatures being put upon them. Of this I am convinced from experience, and it is also the opinion of others :* but if it should ever happen, on cutting off part of the omentum, that a vessel of any size is di-

* A very accurate paper upon this subject may be seen in the third volume of *Mémoires de l'Académie Royale de Chirurgie* of Paris, by Monsieur Pipelet, in which several cases are related of the bad effects produced by ligatures on the omentum.

Mr. Pott is also of this opinion. Vide *Treatise on Ruptures*.

vided, a ligature may with safety be passed upon it with the tenaculum, without including any part of the membrane; and the ends of it being left to hang out at the wound, it may afterwards be pulled away at pleasure.

Another circumstance sometimes occurs, that renders the removal of part of the omentum necessary: when a hernia has been of long duration, and a portion of omentum has been long down, from the pressure made by the usual suspensory bandage, the protruded parts are apt to become thickened, hard, and collected into lumps. When these lumps are not large, they need not be removed, and when small, they may be returned into the abdomen without hazard; but whenever it appears, that by their bulk and hardness they might do mischief if forced into the belly, they ought certainly to be cut off.

When we determine to remove any part of the omentum, the easiest and safest method of doing it is this. The membrane should be carefully expanded at the part intended to be cut, in which state it is easily divided with thin edged scissars, more so indeed than with any other instrument. When fully spread out, any turn of the intestine that may be enveloped in it, is at once brought to view, which, without this precaution, we would run the risk of dividing with the scissars.

When, again, a portion of gut is found to be mortified, if returned in this state, a discharge of feces would certainly take place into the cavity of the abdomen, as soon as the mortified spot should separate from the sound. For the prevention of this, which would soon terminate in the death of the patient, if a small spot only is diseased, we should endeavour, with a needle and ligature, to connect the sound part of the gut immediately above the mortified spot, to the wound in the abdominal muscles. By this the feces are discharged by the wound, when the mortified spot either separates or is cut out; and different instances

have occurred, where the loss of substance produced by the mortification was not extensive, of the opening into the gut becoming gradually less, and at last healing entirely: but whether the event should prove so fortunate or not, whenever a portion of gut is completely mortified, it should be secured with a ligature to the contiguous parts.

And farther, when the mortification is extensive, and includes, so far as it goes, the whole circumference of the gut, the gangrenous parts should be cut out at once; and if the quantity thus taken away is not so considerable as to prevent the ends of the gut from being brought into contact, it should be done immediately in the manner pointed out in Chapter III. Section XII. when treating of wounds of the intestinal canal: this at least affords a chance of the ends of the gut being made to reunite; and if this unluckily should not happen, a passage for the feces will still be secured by the groin.

Although in this manner many have recovered who otherwise must have died; yet it must be admitted, that the risk of patients in this situation is very considerable: but although a small proportion only should recover, still practitioners would be to blame were they to omit those means which afford the best chance to their patients. A patient of my own is now living, and in good health, voiding his feces by the anus, who lost at least one foot of the intestinal canal by mortification in a case of crural hernia; and we are told by different authors, of similar recoveries equally remarkable.

It is to the moderns chiefly, I may remark, that we owe this important improvement in the treatment of hernia. It is even recorded of Rau, who lived in a very late period, that on opening a hernial sac, where a gangrenous state of the parts was discovered, as the case was supposed to be desperate, he laid down his knife, and proceeded no farther in the operation.

The patient, who died next day, would, in modern practice, have had at least some chance for life.

When it is therefore discovered, that mortification has taken place, all the diseased parts should be cut off, and the remaining sound part of the gut being retained with the fingers till properly secured with a ligature, the opening in the external oblique muscle may then be dilated with safety : whereas, if it should be enlarged before the diseased part of the gut is taken away, the gangrenous portion might slip up together with the sound ; but by this precaution, every risk of this kind is avoided.

The parts forming a hernia being all completely replaced, when the sac in which they were contained is found to be hard, enlarged, and much thickened, as no advantage could be derived from preserving it, such parts of it as can be cut away with safety should be removed : all the lateral and foreparts of the sac may be safely cut off ; but being commonly firmly connected with the spermatic vessels behind, this part of it ought not to be touched.

In common practice, the parts are now dressed with soft lint, and a suspensory bag employed for retaining it. But it answers better to draw the sides of the cut previously together, including the skin, cellular substance, and anterior part of the hernial sac, with a proper number of futures, by which the cure is much more quickly accomplished, at the same time that the parts are rendered more firm than they otherwise would be : at one time, this practice appeared to me to be hazardous ; and I advised it not to be adopted, as in two instances a portion of gut got down between the futures, and one of the patients died before it was perceived : farther experience, however, has made it obvious, that this may be always prevented, and that in various ways it proves useful : when the futures are not above half an inch from each other, and made to pass to the bottom of the fore, so as to include all the anterior part of the sac, this accident can never

happen. With a view to give a free vent to any matter that may form in the course of the cut, I have, in some instances, left an opening at the under part of it, but this precaution I now believe to be unnecessary: the futures being completed, the parts should be all covered with a pledget of any emollient ointment, together with some plies of soft lint, and the whole retained by the T bandage.

The patient must now be carried to bed; and being so placed as to have his loins somewhat elevated above the rest of his body, he should in this situation be laid to rest: opiates are here particularly useful: to prevent, or at least to moderate, the fever which commonly succeeds, the patient should be kept cool: in plethoric habits, bloodletting should be prescribed, together with a rigid low diet; and, lastly, if the belly is not naturally open, a frequent use of gentle laxatives is particularly proper.

When, however, the strength has been previously much reduced, either by long sickness or any other cause, instead of bloodletting and a low diet, a nourishing regimen becomes necessary; for if a patient in such circumstances is not properly supported, he will not so readily recover: it is also proper to remark, that, in common practice, the indiscriminate use of bloodletting, and an abstemious regimen, in every case of hernia, appears to be too rigidly adhered to; for, although it proves always useful in hernia, attended with inflammation, yet daily experience makes it obvious, that it proves hurtful where the system has been already much reduced by evacuations, and where no inflammatory symptoms take place.

The fore should be looked at and dressed daily, by which means any change that may take place in it will be quickly discovered: the ligatures in the course of six or seven days should be withdrawn, and as soon as the parts are firmly cicatrized, a well adapted truss should be applied to them, and never afterwards laid aside: some indeed assert, that a truss after this oper-

ation is unnecessary, and where the cure has been accomplished with ligatures deeply placed, in the manner I have pointed out, it might in some instances be so complete, particularly during youth, as to prevent all future descents; but as the contrary has, in various instances, happened, the patient should be always put on his guard against it.

In performing this operation, it was proposed a considerable time ago by Mr. Petit, of Paris, and other French practitioners, to reduce the protruded parts, without dividing the sac: since that period, the practice has been adopted by others. Dr. Monro thinks favourably of it, and on his suggestion I have, in different cases, performed the operation in this manner. But, however unwilling I am to differ from such authority, I cannot in this instance avoid it: the chief reason assigned for not opening the sac, is, that we thereby prevent the air from finding access to the intestines; but although this would be highly desirable, if the operation could otherwise be equally well performed, as it does not appear to me that this can be done, I think it right to observe, that the practice should be received with caution, till, by further observation, it is ascertained, whether it proves beneficial or not. The best mode of doing it would be for the surgeons of those hospitals in which *herniæ* most frequently occur, to perform the operation a considerable number of times in each method, and to judge from the result, for we should not decide upon a point of such importance on the experience to be obtained from a few cases.

The chief objection to the practice is, that unless the hernial sac is laid open, we cannot possibly distinguish the state in which the parts contained in it are; so that parts might be returned into the abdomen in such a state of disease as would add greatly to the hazard of the patient. The intestines are not only liable to mortify, but collections are sometimes found in the

hernial sac, of a fetid putrid serum, which, on being pushed into the abdomen, might do much harm. And besides, it has sometimes happened, on laying open a hernial sac, that the cause of strangulation has been discovered, either in the sac itself, or among the parts contained in it: for although, in a great proportion of cases, a stricture of the passage through which the parts have come down, is to be considered as the cause of all the bad symptoms, yet instances of the contrary sometimes occur; one of which I met with some years ago, and I have heard of others of the same kind. In a case of scrotal hernia of long duration, symptoms of strangulation at last supervened; and on laying open the sac, the appendix vermiformis was found so tightly twisted round a portion of gut, as left no reason to doubt of this alone being the cause of the mischief. If the parts had here been returned without dividing the sac, no advantage would have been derived from the operation; and, after death, the practitioner would have had the mortification to find, that the patient's life might have been saved, if this very necessary measure had not been omitted.

Instances of the protruded parts being returned into the abdomen without opening the sac, are enumerated by different French practitioners; and in some which ended fatally, it was found on dissection, that the strangulation of the gut had been the effect of stricture formed by the parts contained within the sac, and not by the tendon of the external oblique muscles through which they had passed.

Disasters of a similar nature having occurred to Mr. Petit and others, who had adopted the practice, it has long in France been very generally laid aside; but in a point of such importance, this will not be universally done till further experience shall evince whether it ought to be continued or not.

By some again, we are advised to reduce not only the protruded bowels, but even the hernial sac itself; whilst others allege, that the sac can never be reduc-

ed. Mr. Louis, in the paper I have quoted, is clearly of this last opinion, as Mr. Pott also is. But we have the testimony of different authors of credit, and particularly of Mr. Le Dran, to the contrary; and I have now met with it in more than one instance, where the appearances were so unequivocal as to leave no doubt with me respecting it.

In herniæ of long duration, where the parts have been long and repeatedly down, such firm adhesions usually form between the sac and the contiguous parts, as to reduce them apparently into one inseparable mass; so that, in such circumstances, all attempts to reduce the sac would be in vain. But although this would perhaps in every instance be the case in ruptures of long continuance, we are not warranted in supposing that it would be so in every case of recent hernia. We know that the adhesion of one part of the body to another, cannot any where be instantaneously produced. Even where recent division has taken place, and when the divided parts are kept in close contact, the space of some days is commonly required to produce a firm reunion. Now in the case of a portion of membrane being forced into a natural opening, where the parts are neither rendered raw by art, nor are as yet in a state of inflammation, a still longer period must be required for this effect; and in fact, although there is scarcely perhaps an instance of a hernial sac of long duration being reduced, yet there are sundry indisputable facts which show, that in recent ruptures it may be returned. In one of those to which I allude, the gut had been down five or six days, and formed a tumor in the groin of the size of an egg: the sac did not in any point seem to adhere; the operator therefore found no difficulty in reducing it; and on dissection after death, which happened in two days from the operation, the passage through the external oblique muscle was found dilated, but no existence of a sac could be traced into it. This also

was the case with the other, which had been down for twelve or thirteen days. It is not, however, my own opinion, that this is a matter of much practical importance, I mean the possibility of reducing the hernial sac or not; for the reasons I have enumerated against the return of a hernia without opening the sac, occur with equal force against our returning the sac itself unopened.

The observations that I have hitherto made relate chiefly to hernia in the male subject; but as the same openings in the external oblique muscles exist in females, so they are also liable to the variety of rupture we have just been describing.

In males, however, the bubonocoele is more frequently met with than in women, and as in them too the cellular membrane surrounding the spermatic vessels is very lax and dilatable, so hernial swellings of this part are commonly much larger in them than in women. But instances sometimes occur, even in women, of the bubonocoele being of great bulk: I have known the protruded parts fall down to the very bottom of the labia pudendi.

As the openings in the external oblique muscles of females are exceedingly similar to those in the male, so the treatment, of bubonocoele is in them very similar to what is found to answer in men. When glysters, bloodletting, and the other remedies enumerated above do not succeed, the same operation of laying open the hernial sac, and enlarging the opening in the tendon of the oblique muscle, is here equally proper as in the other sex.

With modest women, herniæ often take place without the practitioner in attendance being made acquainted with them; whenever therefore such symptoms of cholic occur in females as give reason to suspect the existence of hernia, a particular examination should always be made, in order if possible to discover the cause of the mischief, from the removal of which alone a cure can be obtained.

In this manner, I have, in different instances, saved the lives of patients, who otherwise in all probability would have died, without the cause of their disease being known: with some women this would happen from delicacy alone; but instances also occur, of *herniæ* ending fatally, where the tumors are so small as scarcely to attract attention even from the patient.

SECTION III.

Of the Hernia Congenita.

FROM the anatomical description given in the first section of this chapter, of the parts chiefly concerned in hernia, it appears, that in the common hernia of the scrotum, the parts protruded from the abdomen must necessarily be contained in a bag or sac perfectly distinct from the testis: in that kind of rupture, the testis therefore remains in its usual situation, surrounded by its own proper membrane the tunica vaginalis, and not in contact with any other part.

But from the same description it appears, that if in early infancy a portion of gut should slip down by the same passage with the testicle, that the parts so protruded must be in immediate contact with the testis, and must thus be contained in the tunica vaginalis; so that in this rupture, very properly by Haller termed *hernia congenita*, the tunica vaginalis testis forms the hernial sac.

The discovery of this variety of hernia, which was reserved for modern times, enables us to account for a number of cases recorded in books of surgery, of the contents of ruptures being found in the same bag with the testicle; a circumstance which, till this discovery, was considered as a clear proof of the peritonæum being frequently ruptured in hernia, as till of late this phenomenon could not otherwise be explain-

ed. But we now know, that the peritonæum is never ruptured in hernia; and that the parts forming a hernial tumor being found in contact with the testicle, is a circumstance easily explained from the more accurate knowledge we have obtained of these parts.

The treatment of the congenital hernia should be nearly the same with that of bubonocoele in its more ordinary form. When the parts can be replaced without an operation, it ought always to be done, a truss being at the same time recommended as a preventive of future descents; and when symptoms of strangulation take place, which cannot be otherwise removed, than by the operation, it here becomes equally proper as in the common form of the disease.

When from a hernia having taken place in early infancy, and from the parts having continued to fall into the scrotum occasionally from that period downwards, there is reason to suspect that a rupture in which strangulation has taken place is of the congenital kind, the surgeon, in dividing the sac, should proceed with still more caution than in common hernia; for the tunica vaginalis which here forms the sac, is commonly much thinner than the usual sac of a hernia. On the parts being returned, more attention is also necessary in dressing the wound than in other cases of rupture; for the testicle being here laid bare by the vaginal coat being cut open, if not treated with much delicacy it might probably inflame, and be thereby the cause of much additional distress and danger. The testis therefore should be immediately enveloped with its own proper covering, the loose tunica vaginalis; and every dressing should be so conducted as to prevent with as much certainty as possible the external air from finding access.

In other circumstances the management of the hernia congenita is the same with that of any other rupture.

SECTION IV.

Of the Crural or Femoral Hernia.

THE seat of the crural hernia, as I have remarked above, is on the upper and anterior part of the thigh; the protruded parts passing out at the same opening through which the large blood vessels of the thigh are transmitted from the abdomen.

In the description given in the first section of this Chapter, of the external oblique muscles of the abdomen, I remarked, that the under edge of these muscles, by doubling backwards, assumes the appearance of a ligament, extending in an oblique direction from the spine of the ileum near to the symphysis pubis, and forming what is commonly termed the ligament of Poupart or Fallopius.

Excepting at its two extremities, where this ligament is attached to the pubes and ileum, it is not in any other part connected with bone. By the particular shape of the ileum at this part, a kind of arch is formed, by the ligament passing over a hollow in that bone, through which the large artery and veins of the thigh find a passage, the rest of the cavity being filled up with cellular substance, glands, and fat; and all these parts again are covered with and tied down by a firm tendinous aponeurosis of the fascia lata of the thigh.

It is under the tendon or ligament just now described, that the parts composing a crural hernia descend. In some instances they pass immediately over the femoral artery and vein; in others, they are found on the outside of these vessels; but more frequently they lie on the inside, between them and the os pubis.

As the protrusion and strangulation of any of the contents of the abdomen, excites nearly the same symptoms, wherever this disease takes place; so the

symptoms of crural hernia are so similar to those described in the two first sections of this Chapter, that it is not necessary to mention them here.

The cure of the femoral hernia is also conducted upon the same principles with that of bubonocoele, described in the second section; so that when symptoms of strangulation take place in it, the same remedies should be employed that were advised above for bubonocoele. Only here, in attempting to reduce the parts by the hand, the pressure should be made directly upwards, instead of obliquely outwards, as was advised in the other; and when these means do not succeed, the operation itself must be employed.

In describing the operation for the inguinal hernia, I advised the external incision to be free and extensive. It is still more necessary in the crural hernia, from the parts concerned in it being more deeply seated. By timidity in making the first incision, the operator is frequently much incommoded in all the subsequent parts of the operation. The external cut should extend at least from an inch above the upper end of the tumor to the same length below the most depending part of it.

The *membrana adiposa*, tendinous expansion of the *fascia lata*, and hernial sac, being all divided, if the protruded parts are found in a fit state for reduction, we should immediately attempt to replace them; and as the space below the ligament through which they have passed is considerable, this may commonly be done without dividing it, merely by pressure properly applied with the fingers, while the patient is placed in the posture directed above for the operation of the bubonocoele as being best suited for favouring a return of the bowels.

When the contents of the tumor can be reduced without dividing the ligament, the patient is thereby saved from a good deal of hazard, as from the situation of the spermatic vessels and epigastric artery with

respect to this ligament, any cut made into it is done with the risk of these vessels being injured.

The spermatic vessels in passing along towards the opening in the external oblique muscle, run nearly upon the very edge or border of Poupart's ligament, so that I consider it as impossible to make a free division of the ligament without cutting them across.

We have been advised indeed by some, in order to avoid the spermatic vessels, which they allow would be wounded, if the incision should be carried directly upwards, to cut in an oblique direction outwards. They admit, that in this way the epigastric artery may probably be divided; but the risk attending the division of that artery they do not consider as of much importance; and if the discharge of blood which it might produce should happen to be considerable, they speak of it as an easy matter to take it up with a ligature; for which purpose needles of various shapes have been invented. Even in emaciated people, however, it is difficult to reach the epigastric artery with a ligature, and in corpulent patients it must often be impossible; so that the younger part of the profession should be cautious in receiving the directions usually given on this point. On reading the remarks of the late Mr. Sharpe on it,* to secure the epigastric artery with a ligature, one would expect to be the easiest of all operations; but the difficulty which attends it, is such, as must convince all who have tried it, that Mr. Sharpe himself never put it in practice.

But even although the epigastric artery could with certainty be avoided, if a hernia is large, the ligament is so much stretched as to bring the spermatic vessels so nearly on a line with the under edge of it, as to render it altogether impossible to divide the one without the other; and whoever will examine these parts in this situation, will see that this cannot be avoided,

* Critical Inquiry into the present state of Surgery.

whether the incision is carried directly upwards, or obliquely outwards or inwards.

Some who have been sensible of the danger attending this part of the operation, have proposed merely to dilate the passage instead of dividing the ligament; and Mr. Arnaud, a French author, delineates a curved levator for the purpose of supporting the ligament till the protruded parts are reduced: but as we are to suppose in every case of strangulated hernia, that the passage through which the parts have fallen down is already dilated to nearly its utmost possible extent, in such a situation to attempt a farther dilatation, without the assistance of the knife, would seldom, it is probable answer any good purpose.

A considerable time ago it occurred to me, that in this part of the operation some assistance might be derived from performing it in the following manner; and having since had occasion to put it in practice with success, I can now with some confidence recommend it. Instead of dividing the ligament in the ordinary way, from below upwards, I make a slight incision into it, about an inch in length, beginning above and proceeding to the under edge of it.

The first scratch with the scalpel should be slight; but by repeated touches, it should be made to penetrate almost through the whole thickness of the ligament, till at last only a thin layer of it remains: in this situation the protruded parts may for the most part be returned with ease, as the ligament where thus weakened by the incision will yield gradually to the pressure applied for the reduction of the intestines.

As in this manner the opening may be enlarged to any necessary extent, and as the spermatic vessels and epigastric artery are thus avoided, the operation may not only be done with equal certainty, but with the same safety, as for any other rupture. For, by not penetrating with the scalpel through the whole thickness of the ligament under which these blood vessels lie, they are thereby kept free from danger during

this part of the operation ; and the pressure afterwards used for the reduction of the protruded parts, if done in a gradual manner, can never injure them materially, as blood vessels of the size and strength of these easily admit of much more extension than is here required.

In every other circumstance, the crural hernia, as I have observed already, requires the same method of treatment with bubonocoele, for which the second Section of this Chapter may be consulted : only I may remark, that the dressings are more easily retained after this operation, by a piece of leather spread with plaster moderately adhesive, than with any kind of bandage.

I have already observed, that the crural hernia is more frequent in women than in men, owing to the particular conformation of the parts in which it occurs. In women the same mode of operating should be observed as in men ; for as in them there is the same risk of wounding the epigastric artery, the same precautions are necessary for avoiding it, and by attending to the directions given above, it may be always done.

SECTION V.

Of the Exomphalos, or Umbilical Rupture.

IN this variety of hernia, the parts protruded from the abdomen pass out at the umbilicus ; and the contents of the hernial sac are here, as in every other rupture, exceedingly various. In some instances they consist of intestines only ; sometimes of omentum only ; and frequently of both. In some, part of the stomach, liver, and spleen, have been found in the sac of an umbilical rupture.

As all these parts are naturally contained in the peritonæum, the hernial sac, it is evident, must here as in other ruptures be formed by that membrane being carried along with such parts as are protruded. Accordingly, in every recent instance of umbilical hernia, this sac is in general evident; but when the tumor is large, the sac becomes so intimately connected with the contiguous parts, in consequence of the weight and pressure of its contents, that many have doubted whether this species of hernia has a sac or not. In some instances the tumor has increased to such a degree, as actually to burst the surrounding parts; not only the sac, and cellular substance, but even the skin itself.

Umbilical herniæ occur most frequently in early infancy, and in corpulent people more frequently than in others, from this obvious reason, that by the great bulk of parts contained in the abdomen of fat people, the surrounding muscles are kept constantly distended, by which the opening at the umbilicus, through which the parts are protruded, is made more pervious: for a similar reason, women in the last months of pregnancy are particularly liable to this rupture.

If attended to in due time, a right bandage will commonly effect a cure; and, when produced by pregnancy, a temporary removal of the disease, is, in general, a certain consequence of delivery. While a woman continues pregnant, we can seldom remove an umbilical rupture, but by employing a bandage early we can in this situation prevent the tumor from becoming larger.

Although different portions of the alimentary canal are occasionally met with in umbilical ruptures; yet by experience we know, that most frequently they contain omentum only: hence umbilical herniæ are not in general so hazardous as other ruptures.

It happens, however, as I have observed above, that in some cases a portion of gut alone is pushed out, by which the usual symptoms of strangulation are apt to

be induced. In this situation, when the means usually employed for returning the gut do not succeed, as a stricture of the passage through which it has fallen, is to be considered as the sole cause of the danger; so a cure, it is evident, must depend entirely on this being removed. In performing this operation, a free external incision along the course of the tumor is the first step to be taken; and on laying the protruded parts bare by a cautious division of the sac, if they are found in a state fit to be returned, and if this cannot be effected but by enlarging the passage into the abdomen, it may be done with safety by introducing the finger, and enlarging the opening with a blunt pointed bistoury. This incision, I may remark, may be made with almost equal safety in any direction; but lest the ligament formed by the umbilical vessels should be wounded, which, however, would not probably do much harm, yet when an operator is of a different opinion, it may always be avoided by making the cut on the left side of the umbilicus, and carrying it a little obliquely upwards and outwards.

When, again, the prolapsed parts, on being laid open, are found to be so much diseased as to render their reduction improper, the directions formerly given for similar occurrences in other cases of hernia, will apply with equal propriety here, and need not now be repeated.

By Albucasis, Guido, Aquapendens, and others, it has been proposed, with a view to obtain a radical cure without the operation, to lift up the skin covering the tumor, with the finger and thumb, so as to separate it from the gut beneath; and a cord being passed round the parts thus raised up, a ligature to be made so tight as to induce mortification over the whole of them.

In other instances again, when the form of the swelling did not admit of this, the same precaution being taken for avoiding the gut, a needle containing a double ligature was introduced through the basis of

the tumor, near to its centre, and the ligatures afterwards tied one above and the other below, of such tightness as to induce the wished for effect.

But as the practice thus recommended did not answer the purpose, for it did not prevent a return of the disease, and as the destruction of skin rendered every future descent more dangerous, so it is now, at least by regular practitioners, very universally exploded.

In Plate LXV. fig. 3. is represented the best bandage I have used for umbilical herniæ.

SECTION VI.

Of Ventral Herniæ.

IN ventral hernia the parts forming the tumor are protruded between the interstices of the abdominal muscles. No part of the abdomen is altogether exempted from these tumors, but they are most frequent in the parts most contiguous to the linea alba; and when the stomach alone forms the tumor, the swelling is situated just under, or immediately to one side of the xiphoid cartilage.

The treatment of this rupture corresponds with that of exomphalos. When the parts are reducible by the hand alone, a cure may be frequently obtained by the constant use of a truss; and, again, when symptoms of strangulation occur, which cannot be removed but by an incision through the stricture, this must be done in the manner pointed out in the last section, so as to admit of the parts being replaced. The after treatment of the parts concerned in the operation, is the same here as in the umbilical rupture.

SECTION VII.

Of the Hernia of the Foramen Ovale.

IN this rupture, the viscera protrude through the foramen ovale of the pubis and ischium. It is not a frequent variety of the disease ; but as it has been met with, it is necessary to describe it.

The symptoms of this hernia being very similar to those arising from strangulated intestines in other parts, they need not be enumerated here : only it is proper to remark, that in this rupture the tumor is in men formed near to the upper part of the perinæum ; and in women, near to the under part of one of the labia pudendi. In both sexes it lies upon the obturator externus, between the pectineus muscle and the first head of the triceps femoris.

The foramen ovale being partly filled up by a membranous or ligamentous substance, and in part by the obturatores muscles, it was commonly supposed that this species of hernia arose from a relaxation of one or other of these ; but as an opening is left in the foramen for the transmission of different blood vessels and nerves, it is now known, that in this rupture the viscera pass out at that opening, by gliding down in the course of these vessels.

The general mode of treatment pointed out in the preceding sections for other herniæ, must be here kept in view ; and when the parts are reduced, a truss properly adapted to the parts, must be trusted to for retaining them. But, as it will sometimes happen in this, as in every other hernia, that the parts cannot be reduced with the hand alone, when this is found to be the case, it must be done by dilating the passage through which they protrude. The tumor, however, that takes place here, being in general so small as scarcely to be noticed but by the most minute atten-

tion, unless a local pain, with the usual symptoms of a strangulated gut happen to lead to it, it is seldom discovered from its size, till it is too late to expect much assistance from art.

But whenever the operation becomes necessary, as it must always be when symptoms of strangulation arise from a portion of protruded gut that cannot by any other means be reduced, after carefully laying the prolapsed parts bare, if they cannot be reduced but by dilating the passage, and as death must ensue if reduction cannot be accomplished, it ought undoubtedly to be attempted : but as it is almost impossible to enlarge this opening with an instrument, without dividing some of the blood vessels that pass out at the foramen ; and as this would probably end in the death of the patient, the depth and situation of the parts rendering the application of a ligature impracticable ; it is more advisable, by means of a flat hook, to dilate the passage to a sufficient size, by gentle gradual stretching. By insinuating the end of the hook between the intestine and ligament, and pulling it gradually upwards, a degree of dilatation may be obtained, sufficient for the reduction of the gut, without incurring that hazard which the division of the ligament with the knife or any sharp instrument must always occasion. A hook for this purpose is delineated in Plate LXVI. fig. 2.

SECTION VIII.

Of the Hernia Cystica, or Hernia of the Urinary Bladder.

IN this rupture, the urinary bladder is the organ protruded ; and the situations in which it occurs, are either the groin and scrotum through the opening in the external oblique muscle of the abdomen ; the

forepart of the thigh under Poupart's ligament; or the perinæum through some of the muscular interstices of that part.* Instances have likewise happened, of the bladder being pushed into the vagina, so as to form hernial tumors of considerable bulk.

As only a part of the bladder is covered with the peritonæum; and as the bladder, in order to get into the opening in the external oblique muscle, or under the ligament of Fallopius, must insinuate itself between that membrane and the abdominal muscles, it is evident, that the *hernia cystica* cannot be covered with a sac, as intestinal ruptures usually are. In the perinæum, again, that portion of the bladder most liable to fall into it, is in no way connected with the peritonæum.

In some instances, this rupture occurs by itself, without any complication; and in others it is accompanied with intestines and omentum, both in inguinal and femoral herniæ: when complicated with a bubonocoele, the protruded portion of the bladder lies between the hernial sac and spermatic cord; that is, the intestinal hernia lies anterior to it.

The usual symptoms of this hernia are, a tumor, attended with fluctuation, either in the groin, in the forepart of the thigh, or perinæum, which gradually subsides when the patient voids urine, and becomes larger when the bladder is full. When the tumor is large, before water can be passed with freedom, it is commonly necessary to employ pressure, at the same time that, when in the groin or thigh, the parts require to be as much elevated as possible; but when the tumor is small, and especially when no stricture has taken place, the patient generally voids urine easily, and without assistance from external pressure.

When a hernia of the bladder takes place without any complication, it commonly proceeds from a sup-

* An instance of this is recorded in vol. iv. of *Mémoires de l'Académie Royale de Chirurgie*, by Mons. Pipelet le Jeune, p. 181.

pression of urine. In the method of cure, therefore, every cause of suppression should, as far as possible, be guarded against; and if the protruded portion of bladder can be reduced, a truss properly fitted to the part, should be worn for a considerable time. But when the parts cannot be reduced, as long as no symptoms appear to render the operation necessary, a suspensory bag, so fitted as effectually to support the tumor without compressing it, is perhaps the only remedy we should employ.

When, again, a portion of bladder protrudes into the vagina, after reducing the parts, which we do by laying the patient on her back, with her loins elevated, and pressing with the fingers from the vagina, descents in future may, in general, be prevented by the use of the pessary represented in Plate LXVI. fig. 1. And the same means, I may remark, are employed with success, in preventing descents of the intestinal canal into the vagina; a species of rupture sometimes met with.

It may happen, however, if inflammation occurs here, that the division of the parts producing the stricture will be as necessary as in any other rupture. In which event, the mode of operating pointed out in the preceding sections should be kept in view. Only it must be remembered, that as in the hernia cystica without any complication, the protruded parts are not covered with a sac, so still more caution is required in laying them bare, than is necessary in common ruptures.

It sometimes happens, that stones are produced in the protruded portion of the bladder. In which event, if it should ever be necessary to cut into them, if the bladder can be easily retained in its prolapsed state till the wound is healed, it ought always to be done, in order to prevent that internal extravasation of urine which otherwise would occur, and which certainly would do harm. The same precaution is necessary,

when by accident in the operation for the hernia cystica, the bladder is opened ; or when any part of it is in a state of mortification, and therefore unfit to be returned into the abdomen.*

* The best accounts of all the varieties of hernia are to be met with in the works of Le Dran, Heister, and of Mauchart, in a *Treatise de Hernia Incarcerata*; in the different volumes of *Mémoires de l'Académie Royale de Chirurgie de Paris*; in the *Medical Essays of Edinburgh*; in the works of the late Dr. Monro; in *Haller de Hernia Congenita*, in his *Opuscula Pathologica*; in Mr. John Hunter's very accurate account of the state of the testis in the fœtus, to be met with in Dr. Hunter's *Medical Commentaries*; in Mr. Pott's and Dr. Richter's valuable works on this subject. These are the best modern authors on this subject; and very little satisfaction is to be obtained from any of the ancient writers upon it.

CHAPTER XXIV.

ON THE HYDROCELE.

SECTION I.

General Remarks on the Hydrocele.

EVERY tumor formed by a collection of water, may, from the import of the word, be called a hydrocele, but, in chirurgical language, the term implies a watery swelling in the scrotum or spermatic cord.

This, as well as all tumors in the scrotum or groin, not immediately produced by the protrusion of parts from the abdomen, were, by ancient writers, termed false or spurious herniæ, from the resemblance which they bear to the true hernia, or rupture; but no advantage is derived from this distinction: and, as it arose from an erroneous opinion of the origin of herniæ, I should not have taken notice of it here, but with the view of making the writings of the ancients upon this subject intelligible.

Indeed, the doctrines of the writers of the last and preceding centuries concerning hydrocele, are so confused and perplexed, that they do not merit attention; for, as they were ignorant of the anatomy of the parts in which the disease is seated, the ideas which they formed of it, gave rise both to an erroneous pathology and pernicious practice. Not being acquainted with the structure of the parts affected, they proceeded with much unnecessary dread in the treatment of the diseases to which they were liable; for, by supposing an immediate connection to subsist between the coats of the testicle, the cavity of the abdomen, liver,

kidneys, and other viscera, they were induced to consider the collection of water in hydrocele, as a deposition from these parts, and as tending to free them, and perhaps the system at large, from diseases of importance.

In consequence of this, their practice was timid and indecisive; so that every surgical operation, in which these parts were concerned, became a matter of much importance to resolve upon, and very tedious, painful, and uncertain in the execution.

From the time of Celsus to the middle of the last century, little progress seems to have been made in this part of surgical pathology. Indeed, from Celsus downwards, authors seem to have copied almost exactly from one another, till Wiseman, Le Dran, Garangeot, and Heister, gradually elucidated the subject: but it was not clearly understood till the discoveries of Monro, Haller, Hunter and Pott, made the anatomy of the parts plain and intelligible. So much attention, however, is still given to the confused accounts of ancient writers, that the real nature of the diseases of the testes, and their appendages, is, from this cause alone, less understood than it otherwise would be. There is perhaps no part indeed of surgery with which students in general are so little acquainted.

Nothing but a strict attention to the discoveries of late anatomists, can convey clear and distinct ideas concerning them; and, whoever will make himself acquainted with these, will find, that the hydrocele and affections of the testes, may be explained with as much clearness and simplicity as any other class of diseases. In the first Section of Chapter XXIII. I gave a description of these parts, in so far as was necessary for the consideration of hernia. Referring to what I had then occasion to say, commencing in page 527, and ending page 533, Vol. II. I have now only to add what may be necessary for understanding more completely the diseases of the testes, and their tunics.

As from the foregoing description it appears, that the testis while in the abdomen is firmly attached to the peritonæum behind, so, when in the scrotum, as the vaginal coat with which it is there surrounded, is evidently a continuation of the peritonæum, it must of necessity be still connected with that membrane, in the same manner as while it remained in the abdomen. And accordingly we find, that, although the testicle lies loose in this sac, or vaginal coat, in every other part; yet, along its posterior part, it is firmly attached to it. At this part, the different vessels of the testis still enter; and at this the peritonæum, or what is now the tunica vaginalis, is reflected over it, and every where closely attached to it, thereby forming the tunica albuginea, or immediate covering of the testicle; so that the tunica albuginea is demonstrably a mere continuation of the other, or vaginal coat.

The inferior part of this process of the peritonæum being somewhat wider below than above, leaves the tunica vaginalis of a pyramidal form; and it is also somewhat longer than the testis, reaching from the superior part of the epididymis, where it begins, to a little below the inferior point of the testicle, where it terminates. It is altogether of such a size as to allow the testis to roll easily within it; its principal use appearing to be, to retain a small quantity of a fine exhalation, which is constantly secreting, either from its own surface, or from the surface of the testis itself, for the purpose of keeping the latter moist and easy.

The vaginal coat, of which I have thus given a description, is the only loose covering belonging either to the spermatic cord or testis: for although, by many, a vaginal coat of the spermatic cord is also described, together with a supposed septum between it and the vaginal coat of the testis, yet no such covering is, on dissection, found to exist. The upper part of what may be called the spermatic process of the peritonæum, is evidently closed, as has been described above, soon after the descent of the testicle; and a

firm adhesion taking place between the cord and that part of the sac with which it is enveloped, no vestige can be traced, either of a vaginal coat of the spermatic cord, or of any particular septum between this coat and the testicle: this, it is of importance to notice, as the diseases of these parts cannot otherwise be understood.

As the diseases we are now to consider are chiefly seated in the coverings of the testis, I have given a more particular account of them, than is necessary in speaking of the testis itself; with respect to which, I shall only observe, that it is evidently very vascular, being composed almost entirely of different convolutions of vessels.

Besides the vaginal coat proper to each testicle, the two testes have for their further protection, a more external covering, the scrotum; a bag formed almost entirely of skin and cellular substance; for that body, the dartos, which has been commonly described as muscular, is now clearly proved to be altogether cellular. Even the septum scroti, or that membrane which divides one testicle from another, is composed of cellular substance in a more condensed state. By air it is easily inflated, and it is also pervious to water; so, of course, it partakes of all those watery effusions, to which the more external parts of the scrotum are liable.

This structure of the scrotum it is necessary to be acquainted with, as, from the descriptions which, till of late, have been given of it, young practitioners are induced to consider it as muscular, and to suppose that the septum, with its rapha, are ligamentous; and hence they are led to be more cautious than they need be in performing operations on this part.

Having thus premised an account of the anatomy of the parts in which the water in hydrocele is collected, I shall now proceed to consider the different varieties of the disease.

All the varieties of hydrocele which have been mentioned by authors, may, I think, be comprehended under the two following, the anasarcaous, and encysted.

In the former, the serum is diffused over all the substance of the part in which it is seated; it is not collected in any particular cavity, but occupies equally all the cells of the part: in that which I term encysted, the water is collected in one distinct bag, and a fluctuation of a fluid is, in general, perceived in it. The scrotum, with its contents, the testicle and its appendages, are liable to both varieties of the disease; and the spermatic cord, with its coverings, are also liable to both. We shall first consider those of the scrotum.

SECTION II.

Of the Anasarcaous Hydrocele of the Scrotum.

THE scrotum, from its cellular structure, and immediate connection with the trunk of the body, is apt to partake of every diffusible swelling with which the upper part of the body is attacked: and, accordingly, we find, that general anasarcaous swellings seldom subsist for any length of time, without affecting the scrotum. A local anasarca of the scrotum, is sometimes indeed produced by a local cause, to wit, by the pressure of a tumor on the lymphatics of the part; by external injuries; and occasionally by an effusion of urine from a rupture of the urethra: but such occurrences are rare; a general disease of the constitution being the usual forerunner of these tumors.

As soon as water has collected in any considerable quantity in the scrotum, a soft, inelastic, colourless tumor is observed over the whole of it; impressions are easily received and retained for some time; the skin

at first preserves its natural appearance ; and the rugæ of the scrotum, which, in a state of health, are obvious, are not for some time much altered ; but as the swelling advances, the rugæ gradually disappear, till at last they are totally obliterated : the tumor, from being at first soft, and of a consistence similar to dough, by degrees turns more firm, and the skin at last acquires an unnatural white shining appearance. At length it becomes large ; and although originally confined to the scrotum, it at last spreads up the groin : the penis likewise becomes affected, and often so swelled and distorted, as to excite much inconvenience and distress ; and although the scrotum is composed of parts which readily admit of dilatation, yet, in some instances, the tumor becomes so enormous, as to burst from one end to the other.

These appearances of the disease are so characteristic, as to render it almost impossible to confound this species of hydrocele with any other tumor of the scrotum.

I have already observed, that instances sometimes occur, of the scrotal anasarca being produced by a local cause ; but, in a great proportion of cases, it is induced by a general tendency to dropsy ; so that the cure will chiefly depend upon the removal of that habit of body, by which it was at first produced.

The treatment of this disease of the system falls to the province of the physician, so that I shall not enter upon it at present ; but the aid of surgery is frequently required, for relieving the distress which these tumors always induce when they become large. In these circumstances, the object of surgery is, by drawing off the water, to diminish the size of the tumor, or even to remove it altogether, which not only gives much immediate relief, but is a means of the distended parts recovering their tone more readily than they otherwise would do. Different methods have been proposed for evacuating the water ; the introduction of a seton, passing a trocar, incisions, and punctures.

All of these, excepting that by the trocar, serve very effectually to evacuate the diffused water ; and therefore we are to adopt that which not only excites least pain, but which is least liable to produce troublesome consequences ; and this unquestionably is the method by punctures.

The seton and long scarifications may discharge the water more quickly than punctures ; but in dropfical constitutions, such as the anasarcaous hydrocele is commonly connected with, they almost constantly do harm. For the first two or three days, scarifications give the patient much satisfaction : the water is almost entirely discharged, the tumor is of course greatly diminished, and much relief is thereby obtained. About this time, however, the scarified parts commonly begin to fret, their edges turn hard and inflamed, and by degrees, an erysipelatous redness spreads over the neighbouring parts.

That fretful uneasiness at first complained of, terminates at last in what the patient terms a burning kind of pain, which frequently becomes so tormenting, as entirely to destroy rest ; and it too commonly happens, that all our remedies fail in preventing the accession of gangrene, by which the patient is in general carried off.

I will not say that scarifications always end in this fatal way ; but I have in many instances found that they did so ; and, on the contrary, although punctures sometimes terminate in the same manner, they are by no means so ready to do so.

As scarifications are so apt to do harm, there is much reason to suspect that the trocar and seton, which both excite still more irritation, would prove still more hurtful. They are now, accordingly, in the anasarcaous hydrocele very generally laid aside.

When scarifications are to be employed, we make them with the shoulder of a lancet : they should penetrate the cutis vera, but should not be carried to a greater depth, and they should not exceed an inch in

length : punctures should be carried to the same depth ; and they, as well as scarifications, should be always on the most prominent and most depending parts of the tumor : punctures are best made with the point of a lancet : five or six are commonly sufficient at once ; but as they are apt to heal before the serum is all discharged, they require from time to time to be renewed.

Preserving the parts dry, by a frequent renewal of dry linen cloths, in order to imbibe the moisture, is here a very necessary attention ; indeed, the want of it seems often to be the cause of much of the mischief that ensues from this operation.

When either scarifications or punctures go wrong, by beginning to inflame and turn painful, instead of the warm emollient poultices and fomentations usually employed, a cold saturnine solution applied upon soft linen, not only proves more effectual in putting a stop to the inflammation, but affords more immediate relief to the present distress. Lime water, employed in the same manner, proves also an useful application.

Mortification, however, will take place in some instances, notwithstanding all that we can do to prevent it : in this case, we trust chiefly to the internal use of bark, wine, and other tonics, and to warm dressings and other external applications usually employed in gangrene : as this variety of gangrene is almost always accompanied with much irritation, I often give opium with advantage : opium proves chiefly useful, by removing pain and general irritability ; but as we know from experiment, that it acts as an antiseptic, it may in some cases stop the progress of gangrene, by acting directly on the diseased parts.

In a great proportion of cases, the utmost danger is to be dreaded from the punctured parts being attacked with gangrene ; yet, in a few instances, very unexpected cures are obtained, after all the teguments have been destroyed by it. A remarkable instance of this occurred some years ago, in the Royal Infirmary here :

the whole scrotum separated, and left the testicles bare. During the time that the fore remained open, all the water collected in other parts of the body was evacuated, and, by the use of large quantities of bark, and mild dressings to the fore, the patient got well. In the course of the cure, the testes became enveloped with a thick cellular substance, which served as a very good means of protection. It must have been some similar production, I suppose, which Hildanus speaks of as a regenerated scrotum.*

I have already observed, that, although the anasarous hydrocele depends, for the most part, on a general tendency to dropsy, that some instances, however, occur, of a local cause producing a mere local dropsy of the scrotum. Thus it has, in some instances, arisen from tumors in the groin and abdomen obstructing the passage of the lymphatics. In this case, if the tumors producing the obstruction can be extirpated, no other means will afford such effectual relief; but, when so deeply seated as to render any attempt for removing them unsafe, the practice I have pointed out, of making punctures in the most depending part of the tumor, must be employed, from time to time, to palliate the symptoms.

It has sometimes happened, in suppression of urine, whether arising from strictures in the urethra, or from stones impacted in it, that the urethra has burst, and the urine, in this manner, getting access to the cellular texture of the scrotum, an anasarous swelling rises immediately over the whole of it; nor does it commonly diminish till the cause by which it is produced is removed.

In order to prevent the formation of sinuses, which, in such circumstances, will otherwise be apt to occur, an incision should be made into the most depending part of the scrotum, and carried to such a depth as is sufficient for reaching the wound in the urethra. In

* *Observat. Chirurg. Cent. 5. Obs. 76.*

this manner, a free vent will not only be given to the urine already diffused, but the further collection of it may probably be prevented. If a stone impacted in the urethra is found to be the cause of the effusion, it should be cut out ; and, if the obstruction is produced by strictures, they must be removed by a proper use of bougies. The cause being thus removed, if the habit of body of the patient is good, and untainted with any venereal or other general affection, by dressing the fore properly, with soft easy applications, the opening in the urethra will probably heal, and a complete cure will, in this manner, be obtained. But when these ailments are complicated with any general affection, particularly with lues venerea, neither mercury nor any other internal medicine, will remove them.

Cases of this kind must have occurred to every practitioner. I have met with them, both in the hospital and in private practice ; where, notwithstanding all the internal remedies that were employed, the passage from the urethra remained open, and continued to afford a vent to the urine. In such cases, we depend chiefly upon a proper application of bougies.

The scrotal anasarca, of a local nature, has also happened from the rupture of a hydrocele of the tunica vaginalis testis : when the hydrocele of the tunica vaginalis arrives at a great size, jumping from a height, or a violent blow or bruise, will readily burst it ; and the water, not finding a passage outwardly, must necessarily diffuse itself over the scrotum. Different instances of this have been met with, two of which are related by Douglas ;* and others have fallen within my own observation. A swelling of a similar kind is also sometimes induced by the water of the hydrocele of the tunica vaginalis being improperly drawn off in the operation of tapping. When the orifice in the skin is allowed to recede from the opening in the va-

* Treatise on the Hydrocele, by John Douglas, p. 8.

ginal coat before the water is all discharged, as is apt to happen when the operation is done with a lancet, the remainder of the collection diffuses itself through the cellular substance of the scrotum, an inconvenience that may be always prevented, by using a trocar for this operation, instead of a lancet.

In whatever way the swelling is produced, the cure should consist in laying the tumor sufficiently open, not only for evacuating the diffused serum, but for effecting a radical cure of the hydrocele of the tunica vaginalis.

Some have imagined, that danger may ensue from performing the radical cure for the hydrocele in this situation ; but I have done it in different instances, and no harm has ever ensued from it. The patient, in some cases, may decline the operation, and, in others, his habit of body may render it improper ; but, when this does not happen, few will doubt of its being better to give a patient, in such circumstances, immediate and effectual relief, by performing the radical cure at once, than to subject him, in the first instance, to a good deal of confinement, for removing the diffused swelling of the scrotum, and to leave him under the same necessity as before, of submitting to the radical cure for the hydrocele of the tunica vaginalis.

When, for either of the reasons, however, that I have mentioned, this operation is not to be performed, we endeavour to assist the discussion of the tumor, by suspending the scrotum ; confining the patient to a horizontal posture ; and by the application of astringents to the parts affected. Of these we have a great variety ; but I have found none answer so well as a cold solution of crude sal ammoniac, in the proportion of half an ounce of the salt to a pound of water and two ounces of vinegar ; or poultices, prepared with crumb of bread, soaked in equal parts of cold water, vinegar, and brandy.

I have thus considered all the varieties of anasarcaous tumors, to which the scrotum is liable, together

with the mode of treatment that appears to be adapted to each of them ; for, with respect to the hydrocele of the dartos, a disease particularly described by ancient writers, as that part of the scrotum is now known to be entirely cellular, so any water collected in it must tend to form that very disease we have just been describing, an anasarcaous swelling of the whole scrotum.

We now proceed to consider that species of hydrocele which, from being seated within the cavity of the scrotum, may be termed the encysted hydrocele of the scrotum. Of this there are two varieties, the hydrocele of the tunica vaginalis testis, and that species of tumor formed by water collected in the sac of a hernia.

SECTION III.

Of the Hydrocele of the Tunica Vaginalis Testis.

WHEN treating of the anatomy of these parts, I had occasion to remark, that, in a state of health, an aqueous secretion is always found in the tunica vaginalis ; the principal use of which seems to be, to lubricate, and keep the surface of the testicle soft and easy.

In a state of health, this fluid is absorbed by the lymphatics of the part, its place being supplied by a fresh secretion ; but, in disease, it frequently happens, either that the secretion of this fluid is morbidly increased, or the powers of the absorbing vessels of the part are diminished. The effect of either of these causes must be, to induce a preternatural collection in the cavity of the vaginal coat ; and thus the variety of hydrocele is produced that we are now to consider.

The symptoms induced by it are these : a soft colourless tumor is at first perceived at the inferior point

of the testicle ; chiefly remarkable when the patient is erect : it excites no pain, and it does not become less by pressure. The shape of the tumor is at first nearly globular ; but it afterwards becomes pyramidal, being larger below than above : as it advances in size, it becomes proportionally more tense, and the natural rugæ of the scrotum less perceptible. For a considerable time, it does not extend farther than the usual boundaries of the scrotum ; but, on longer continuance, it advances to the abdominal muscles : so that, although in the early periods of the disease, the spermatic cord may be distinctly felt ; in its more advanced state, it is not easily distinguished.

Before arriving at this height, the weight of the tumor is for the most part considerable, by which the skin of the contiguous parts is dragged so much downwards, as to make the penis shrink considerably, and sometimes disappear almost entirely. In this advanced state of the disease, the testicle, which usually lies at the back part of the tumor, and which, for some time after its commencement, could be distinctly felt, is not so clearly discovered. On minute examination, however, a hardness may always be felt along that part of the scrotum where the testis is situated ; and at this point, pressure excites some degree of uneasiness.

In a great proportion of cases, the fluctuation of a fluid is obviously distinguished on pressure. It sometimes happens, however, in that tense state of the tumor, usually produced by a long continuance of the disease, that the fluid contained in it is not evidently discovered : nor, in this situation, is the ordinary characteristic mark of hydrocele more to be depended on ; I mean the transparency of the tumor, when exposed to the light of a candle, or of the sun. In the early stages of the disease, when the contents of the tumor are not discoloured, and the vaginal coat has not acquired much thickness, the fluid contained in it, on being exposed to this trial, usually appears transparent ; and, in meeting with this, we necessarily con-

sider it as a corroborating proof of the existence of serum. The absence, however, of this, is not a proof of the contrary; for, as the transparency of the tumor depends entirely on the nature of its contents, and on the thickness of its coverings, whatever tends to render the one less clear, and the other of a more firm texture, must, in proportion to this effect, invalidate the certainty of the test.

During the whole continuance of the disease, the patient does not complain of pain in the tumor itself; but some uneasiness is commonly felt in the back, by the weight of the tumor on the spermatic cord. This, however, is generally prevented entirely, or much alleviated, by the use of a suspensory bandage.

These are the usual appearances of a hydrocele when confined to one side of the scrotum. In some instances, however, we meet with a double hydrocele, when the tumor occupies the cavities of both tunicae vaginales, and instead of being confined to one side of the scrotum, extends equally over the whole of it.

As this variety of hydrocele is sometimes confounded with other diseases, it is particularly necessary to hold such circumstances in view, as most certainly tend to characterize and distinguish them. These diseases are, all the varieties of scrotal herniæ; the anafarcous hydrocele of the scrotum; the encysted hydrocele of the spermatic cord; the farcocele, or schirrous testicle; and the hernia humoralis, or inflamed testis.

In the hydrocele of the tunica vaginalis, the tumor begins at the bottom of the scrotum, and proceeds slowly upwards. It is of a smooth equal surface. In a great proportion of cases the spermatic cord is felt at the upper part of it, and the fluctuation of a fluid is distinguished through its whole extent. Pressure does not make the swelling recede, nor is it affected by the posture of the patient, if it be not on its very first approach; whereas, in hernia, besides pain, sick-

ness, and other affections of the stomach and bowels which commonly take place, the tumor begins in the groin, and only at last proceeds to the scrotum. It has not the pyramidal form of a hydrocele. It is frequently soft and compressible, giving a sensation similar to what we receive from pressure upon dough; but no equal or distinct fluctuation is perceived in it. In most instances, the tumor can be made to recede, either altogether or in part, by moderate pressure, and putting the patient in a horizontal posture; and in hernia descending to the scrotum, the spermatic cord can never be clearly distinguished.

However improbable it may appear, this variety of hydrocele has, in some instances been confounded with anasarcaous tumors of the scrotum; but the means of distinction are so evident, from the history which I have given of the two diseases, that it is not here necessary to enter farther upon the subject. It must, indeed, be gross inattention only that can ever make the anasarcaous hydrocele be mistaken for any other disease.

From the encysted hydrocele of the spermatic cord, it may commonly be distinguished by the testicle in the latter being plainly felt at the under part of the tumor; whereas, in this disease, the testis is seldom distinctly perceived if it be not at the back part of the tumor. In two cases, I have met with the testicle on the anterior part of a hydrocele; and, in a third, although fixed behind in its usual situation, it also adhered at one point to the middle and anterior part of the tunica vaginalis. This I suspected to be the effect of inflammation, induced either by hernia humeralis or some other disease; and on inquiry, it appeared that the patient at one time had been long confined with inflammation of this testicle, the effect of a bruise.

In the encysted hydrocele of the cord, the tumor first appears above the testicle, and by degrees falls downwards; while the very reverse happens in the hy-

drocele of the tunica vaginalis, in which the tumor at first always forms below, and from thence proceeds upwards.

In a few instances, these two varieties of hydrocele have been known to exist at the same time in the same patient. In this case the serum, although collected in two distinct cysts, gives the appearance of one uniform tumor; and a fluctuation is distinctly felt from one end of it to the other. But, in any instance that I have seen of this combination, the tumor has been somewhat contracted, having rather a less diameter at that part where the two collections are separated from each other; so that, where this appearance takes place, we may, in general, suspect that the serum is collected in two distinct bags. This, however, does not always happen; for occasionally I have met with this appearance where the disease was fixed in the tunica vaginalis alone.

The circumstances which most clearly distinguish hydrocele from a schirrous testicle are these: in the latter the swelling is hard; it does not yield in any degree to pressure; the surface of the tumor is commonly rough and unequal; it is in general attended with a good deal of pain, and is always heavy in proportion to its size: whereas, in hydrocele, the swelling commonly yields to pressure; its surface is smooth; little or no pain takes place; and the tumor is light in proportion to its bulk.

These differences will always serve as a sufficient means of distinction between this species of hydrocele and a pure unmixed sarcocoele. But when a schirrous testicle is combined with an effusion of water into the tunica vaginalis, forming what has very properly been termed a hydro-sarcocoele, the means of distinction are not so obvious. In the incipient state of these effusions, the difference between the two diseases is sufficiently apparent; but, when far advanced, the most attentive observer often finds it difficult, and sometimes

impossible, to mark the distinction. In such doubtful cases, however, by proceeding in the cautious manner to be afterwards pointed out, no detriment will occur to the patient, from any uncertainty that may take place.

From the *hernia humeralis*, this species of hydrocele is easily distinguished. In the former, the tumor succeeds either immediately to some external bruise, or it is evidently the consequence of a gonorrhœa, or of some other inflammatory affection of the urethra.* The skin is more or less affected with an inflammatory redness; it is attended with much pain, especially on being handled, and the tumor is hard and firm, so that no fluctuation is felt in it, unless in its more advanced state, when suppuration sometimes, although rarely, takes place between the scrotum and testicle; in which case, the usual symptoms of abscess, particularly the pointing of the tumor, and its being much discoloured, serve to distinguish it.

In forming a prognosis of this disease, we should be chiefly directed by the habit of body of the patient. In a great proportion of cases we are to consider it as a local affection; and, in this state the most favourable expectations may be formed of it. For, whatever may have been alleged by some, of the hazard of every operation for a radical cure, in a simple unmixed hydrocele, if the constitution is not very unhealthy, it may at all times be advised with a very fair prospect of success.

In the radical cure of the hydrocele, in whatever way it is done, some pain will be excited; the parts will inflame, and of course some degree of fever will take place. In some instances, these symptoms have gone rather farther than was wished for; but, under the limitations I have mentioned, of an unmixed state

* The operation of lithotomy is frequently attended with an inflammation of one, and sometimes of both testicles; probably from the inflammation induced by the operation in the neighbourhood of the *caput galinaginis*, being communicated along the *vas deferens* to the testis.

of the disease, in a constitution otherwise healthy, the operation I shall presently describe, when properly performed, and the cure thereafter rightly conducted, never fails of the most complete success, while, in no instance, has it ever, in the course of my experience, proved fatal.

But, on the contrary, in constitutions otherwise diseased, in very aged people, and in infirm habits of body, we are by no means to expect such certain success: even in such circumstances, however, the operation often succeeds. I have, in various instances, performed it under one or other of these disadvantages, and I never knew it fail. Others, however, have found that it has done so; and it may readily be supposed, when practised upon the old, infirm, and diseased, that the symptomatic fever may run too high for the strength of the patient; and that the suppuration produced by a high degree of inflammation, may afterwards tend to destroy the remains of a constitution already greatly impaired. This, however, should not be laid to the account of the operation, but to the impropriety on the part of surgeons, in advising it in patients already perhaps in danger with other diseases. In such circumstances, no operation should be performed, and the patient should be desired to trust entirely to a proper use of a suspensory bandage.

In judging therefore of the event of a hydrocele, I would say, that in constitutions such as the operation should be advised in, scarcely any danger is to be dreaded; while, on the contrary, in the infirm, and especially in such as are otherwise unhealthy, that some risk will occur from any operation we can propose, and that the degree of risk will be nearly in proportion to the nature and extent of that disease with which the constitution is affected.

As long as a hydrocele keeps within moderate limits, patients in general, rather submit to the inconvenience than undergo the pain of an operation; at least this is commonly the case with people of rank, who

can more readily submit to any distress which it excites, than patients of a poorer class, whose labour is frequently impeded by the size of the tumor. At last, however, by its bulk, it excites in all a strong desire to have it removed ; for, besides the desire naturally implanted in all mankind, to be sound and entire in these parts, the water collected in a hydrocele, is, in some instances so very considerable, as to be the cause of much inconvenience. When, from timidity, or any other cause, the operation has been too long delayed, I have known the tumor become so large, as in course of time to cover a considerable part of each thigh, and in length to extend from the groin to the knee.

Various methods have been proposed for the cure of hydrocele ; all of which, however, may be reduced to two : such as have in view only a temporary relief, and which is therefore termed the palliative cure ; and such as are meant to effect a radical cure, or a final removal of the disease.

Whatever advantages may be experienced from the use of internal medicines, in dropsy of the constitution, no practitioner, I believe, has so much confidence in remedies of this class, as to expect much advantage from them in encysted dropsy of any kind. We have daily proofs of their failure in partial hydropic collections, wherever they are seated ; and in none more frequently than in the hydrocele.

We are told, indeed, of this disease being cured by different medicines, particularly by the use of drastic purgatives ; but, although I have often known them employed, it was never with any advantage, and, when pushed to any extent they are sure to do harm. As it is always proper, however, to confine the patient to bed for some time after any operation of importance, in order to prevent him from being afterwards disturbed, his bowels should be emptied by a purge immediately before any operation for the radical cure of a hydrocele is performed ; but this is almost the only way in which purgatives can here prove

useful. Internal medicines, therefore, being found ineffectual and we know of no external applications to be depended upon, we are to seek for that relief from surgery which experience shows it never fails to afford.

When the tumor in the scrotum has become so large as to be inconvenient from its size, if the patient either refuses to submit to the operation for a radical cure, or if his state of health renders that operation improper, in such circumstances, the palliative treatment, or a mere evacuation of the water by puncture, is the only means we can employ.

Two methods are proposed for drawing off the water in this manner; by the puncture of a lancet, and piercing with a trocar. By some it is alleged, that by the puncture of a lancet the water can neither be so completely or so properly drawn off as with a trocar; for the orifice in the skin being apt to recede from the opening in the tunica vaginalis, the water is thereby either stopt altogether, or it is apt to insinuate into the surrounding parts. By others again, it is said, that the difficulty of introducing the trocar is such as to render it hazardous from the contiguity of the testicle; and instances are not wanting to show, that even in the hands of expert surgeons, the testis has been much injured by a trocar reaching it in this operation. Indeed the ordinary triangular form of this instrument makes it both difficult and unsafe to introduce it; but the trocar, of a flat form, an improvement which I proposed a good many years ago, enters with as much ease as a lancet. This instrument is represented in Plate LXVII. fig. 4. and in Plate LXXIII. fig. 2. another form of the trocar is delineated, with either of which, an opening may be made in the tunica vaginalis with perfect safety, and the water with this instrument being much more freely drawn off than with a lancet, by which effusions are often produced into the cellular substance of the scrotum, the use of a lancet for this purpose should therefore be laid aside.

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The instrument being fixed on, the next point of importance is the part of the tumor in which the puncture should be made. Even in this simple operation, an acquaintance with the anatomy of the parts proves useful. The testes, as I have endeavoured to show, do not hang loose in their vaginal coats; being, on the contrary, firmly attached to them behind. Hence at this part, even in the largest hydrocele, no fluid is met with; so that if, through ignorance or inattention, the trocar should be inserted here, one instance of which I have seen, the instrument would pierce the body of the testis, while it would not lessen the tumor, as it would not reach the cavity of the vaginal coat in which the fluid is collected. The trocar should be introduced in the anterior and most depending part of the tumor.

The patient being seated in a chair, or on a table, with the scrotum hanging over the edge of it, the operator, with his left hand, should grasp the tumor behind, in such a manner as to push the contained fluid as much as possible into the anterior and under part of it. This being done, if a common round trocar is used, a small opening about a quarter of an inch in length should be made through the skin, with the shoulder of a lancet, on that point where the trocar is to enter; but with a flat trocar this precaution of previously dividing the skin is unnecessary. The operator now takes the trocar in his right hand, and having fixed the head of it in the palm of his hand, he places the forefinger along the course of it, leaving as much of the point of the instrument uncovered as may freely penetrate the tunica vaginalis; and this being pushed in, the stilette should be withdrawn immediately on the end of the canula having entered the cyst. The water will now run off; and, if the tumor is not uncommonly large, it may be all drawn off at once; but when the swelling is large, as the sudden discharge of the fluid, by taking away too quickly the support which it gave to the vessels of the testis and vaginal

coat, might endanger the rupture of some of them, it is better from time to time to stop the flow of it for a few seconds ; and when the whole is thus evacuated, and the canula withdrawn, a piece of adhesive plaster should be immediately applied to the orifice ; and a compress of soft linen being laid over the scrotum, the whole should be firmly supported, either with a well adapted suspensory, or a proper application of the T bandage.*

The patient being in this state laid in bed, all kind of uneasiness is, in a few minutes, commonly gone, and he goes about his ordinary business without interruption. In a few instances, however, it has happened, either from the external air finding access to the testicle, or from the sore produced by the trocar becoming inflamed, that the whole body of the testicle has been seized with inflammation, by which a radical cure of the disease has been obtained. This, however, is a rare occurrence, and hardly to be looked for.

About four years ago, the public was favoured with some observations on this disease by Mr. Keate, of London, in which some cases are related of hydrocele being cured by the external use of a stimulating application, a strong solution of sal ammoniac in vinegar and spirit of wine. The following is the formula employed by Mr. Keate :

℞. Sal. ammoniac. in pulv. trit. $\frac{3}{4}$ i.

Acet. spirit. vin. rect. sing. $\frac{3}{4}$ iv.

A quantity of soft old linen, well moistened in this, is desired to be folded round the scrotum, to be supported with a suspensory bag, and renewed three times a day : but, although I have given this method a fair trial in upwards of twenty cases, in some while the cyst remained distended, and in others immediately after the water was drawn off, I have not been so fortunate as to succeed. In some, the application of dis-

* Some very judicious remarks, on the importance of a due compression in such cases, may be met with in remarks upon this subject, in the works of the late Dr. Monro.

ferent stimulants and astringents after the operation of tapping, has appeared to prevent the collection from returning so quickly as it otherwise might have done ; but even this has not been frequent, and in no instance, in the course of my observation, has it produced a cure.

With the same view, I have employed a variety of stimulants and astringents, such as volatile liniment, prepared with six parts of oil, one of camphor, and one of spirit of hartshorn ; tincture of cantharides ; the steams of vinegar ; poultices of vinegar and crum of bread ; and compresses of linen, soaked in brandy : and the practice being neither attended with difficulty or hazard, I mean to continue it till farther experience shows, whether it should be retained or not. That it will often prove successful in removing a hydrocele, by promoting the absorption of the fluid contained in the tunica vaginalis, is scarcely to be expected ; but we may reasonably suppose, that stimulating applications, capable of exciting inflammation in the testes, may accomplish a cure, after the water has been drawn off with a trocar.

Drawing off the water with a trocar is an operation easily performed, and it very seldom does harm ; but when not done with caution, especially when the patient is allowed to walk or ride soon after the water is taken away, it sometimes ends in very troublesome symptoms. If the habit of body is bad, this will happen with whatever attention it may be done. Of this every practitioner may have met with instances ; and two are related by Mr. Pott, one of which terminated fatally, and gangrene ensued in the other, which, in a few days, destroyed not only a good deal of the scrotum, but even a considerable portion of the tunica vaginalis.* Both of these, indeed, occurred in very unhealthy constitutions ; but it is proper to have it known, that even this operation may, in certain hab-

* Cases *xxi.* and *xxii.* Treatise on the Hydrocele.

its of body, be productive of very distressful consequences.

Drawing the water off in this manner, in order to give relief from the bulk and weight which it produced, would probably be the first idea that occurred to practitioners in the treatment of hydrocele; but being found inadequate to the complete removal of the disease, various other methods were afterwards introduced. The actual cautery, and the ligature, were both proposed as means of preventing farther descents of water from the abdomen, which, in former times, was considered as the origin of this disease. Celsus advises the cyst of a hydrocele to be cut away, and many of his followers do the same. Tents, both solid and hollow, were afterwards employed; as was likewise the use of the seton, which we find recommended by Fabricius ab Aquapendente, and other writers, even of a more early period. Various applications, of the caustic kind, have at different times been in vogue: injecting wine, diluted ardent spirits, and other irritating liquids, into an opening in the vaginal coat, has been proposed, as a means of inducing a degree of inflammation sufficient for effecting a radical cure; and a simple incision of the cyst containing the water, has been practised for the same purpose. These are the means which, at different periods, have been employed for the cure of hydrocele. Ancient practitioners seem to have been acquainted with all of them; but having very inaccurate ideas of the anatomy of the parts concerned, they could not have any fixed or clear opinion of the manner in which any of their remedies acted in effecting a cure. In consequence of this, they were applied at random; and none of them proving in general successful, the ignorance they laboured under in the theory of the disease, made them frequently propose varieties in the method of cure.

The moderns possess one important advantage over the ancients, from knowing that the water in hydrocele is contained in a particular cyst having no imme-

diate communication with any other part or cavity of the body, and from finding that this disease resembles, in many respects, other encysted tumors, with the means of curing which they are well acquainted.

Both in encysted tumors and hydrocele, the contents of the swelling are secluded from the external air. Neither of them have any communication with any other part of the body; and, although the bag containing the matter of an encysted tumor, is in some measure, a new formation, yet in many instances, it is found to be equally firm and elastic with the tunica vaginalis testis.

In the treatment of encysted tumors, practitioners are now agreed, that besides evacuating the matter, means must be employed for destroying the cavity which contained it, otherwise it will collect again. To accomplish this, different methods have been proposed; some with a view to destroy entirely the cyst which contained the matter, and others, as it is said, to fill up the cavity, by a formation of new parts.

But we know, that unless the coats of a cyst are much extended, hard, or greatly thickened indeed, no part of it should be removed. It is also known, that to fill up the cavities of tumors with a formation of new parts, is a mere imaginary thing, being what neither nature or art can do to any extent; and we likewise know, that the cavity of every tumor may be more effectually destroyed by producing an adhesion of its sides, than by any other means.

Parts of the human body, in a state of inflammation, very readily adhere together. So easily indeed do they do so, that some art is required to prevent the adhesion of contiguous inflamed parts, of which every practitioner must have met with examples. Hence, abscesses and encysted tumors are more easily cured by exciting inflammation over their internal surfaces, after their contents are evacuated, than by any other means; and, in like manner, it is now known, that the hydrocele of the tunica vaginalis may be treated

upon the same principles, and with the same general effects.

This is the most simple idea that can be given of the practice that should be kept in view in the cure of hydrocele; and I hope it will serve to render it clear and intelligible.

The intention, then, of every means now in use for the radical cure of this species of hydrocele, is, to induce such a degree of inflammation on the parts in which it is seated, as may tend to obliterate entirely the cavity of the tunica vaginalis, by making it adhere firmly to the tunica albuginea, the surface of the testicle.

Some individuals, indeed, still proceed upon the supposition of a total destruction of the sac being necessary for a complete cure; but extensive experience now makes it evident that this is not the case. When the sac has become unusually thick or hard, it proves sometimes useful to remove those parts of it that are particularly diseased; and when it has been distended to such a degree as entirely to have lost its tone, removing a part of it may forward the cure, by allowing the scrotum to contract more readily; but it happens so seldom from any of these causes, that I have only met with a very few instances, in which it appeared necessary to remove any part of it. A cure may indeed be obtained of this variety of hydrocele, by removing the sac entirely; for the contiguous parts from which it is cut away, readily adhere together, so as to destroy the cavity in which the fluid was contained; but what I wish to have understood, is, that we are not to consider it as necessary, as the same end may be obtained by much more lenient measures.

I shall now proceed to speak more particularly of the several means at present most frequently employed by practitioners for effecting a cure, and shall treat most minutely of those now in general use. These are, excision of the tunica vaginalis; the application of caustic; the use of a seton; a simple incision of

the sac ; and injecting wine and other acrid liquors into the tunica vaginalis, after drawing off the fluid which it contained.

The method of cure, by removing the vaginal coat, which was well known to the ancients, had nearly fallen into disuse, when it was revived by the late Mr. Douglas of London ; and by a few practitioners it is still continued. The method of doing it is, first to dissect out an oval piece of the scrotum, which Mr. Douglas considers as always necessary ; and having then laid the vaginal coat open, to cut it away by different snips with scissars. But, whoever may continue to think favourably of the excision of the sac, will find, that it may be more easily done with a scalpel than with scissars ; and it can seldom or never be necessary to remove any portion of the scrotum.

As much danger might ensue from the incision being carried too near to the testicle, all the posterior part of the sac, or that part of it by which the testicle is connected to the scrotum, should be allowed to remain. On the sac being removed, the parts must be dressed, and treated in every other respect in the same manner as in the operation with the simple incision to be hereafter described.

The cure by caustic has commonly been conducted as follows : the scrotum being shaved, a piece of common paste caustic, properly secured with adhesive plaster, is applied, of about a finger's breadth, the whole length of the tumor ; and if, on removing the caustic, it has not penetrated the tunica vaginalis, an opening is made in it with a scalpel, so as to evacuate the contents, lay bare the testicle, and admit of proper dressings.

But Mr. Elfe, one of the latest writers in favour of the method of cure by caustic, says, that there is no necessity for such an extensive application of caustic as many have recommended ; that an eschar, of the size of a shilling, is sufficient ; that this may be always fully obtained by the application of caustic paste, of

the size of a sixpence, which he directs to be laid upon the anterior and under point of the scrotum, and to be properly secured by adhesive plaster, in order to prevent it from spreading.*

The caustic commonly produces all its effects in the space of five or six hours, and may then be removed. At this time, digestives, or an emollient poultice, must be applied over the scrotum ; and the whole properly suspended with a bandage.

Inflammation, Mr. Else observes, is soon induced over the whole tunica vaginalis ; and the febrile symptoms that succeed, he advises to be kept moderate by bloodletting, injections, emollient poultices, and a low regimen. In a few days, the eschar of the scrotum separates, and comes away ; and, in a gradual manner, in the course of four, five, or six weeks, the whole tunica vaginalis comes off, when the wound, for the most part, soon heals, and a complete cure is obtained.

In the cure of the hydrocele by the seton, the following is the method of applying it, as advised by the late Mr. Pott, who wrote a full and ingenious treatise on the subject : he used a trocar ; a silver canula, five inches in length, and of such a diameter as to pass easily through the canula of the trocar ; and a probe, six inches and a half long, having, at one end, a fine steel trocar point, and at the other, an eye, which carries a cord of coarse white sewing silk, of such thickness as to pass easily through the long canula. With the trocar the inferior and anterior point of the tumor is to be pierced ; and, as soon as the perforator is withdrawn, and the water discharged, the seton canula is passed through that of the trocar, till it reaches the upper part of the tunica vaginalis, and is felt in the superior part of the scrotum. This being done, the probe, armed with its seton, is to be conveyed through the latter canula, the vaginal coat and tegu-

* Vide An Essay on the cure of the hydrocele of the tunica vaginalis testis, by Mr. Else, 2d edit. p. 38.

ments to be pierced with the point of it, and the seton to be drawn through the canula, till a sufficient quantity is brought out at the upper orifice, when both canulas are to be withdrawn, and the operation is finished.

About the end of the third day, the parts begin to inflame; when fomentations, poultices, a suspensory bandage, a temperate regimen, and a lax belly, are ordered, to keep the symptoms moderate. As soon as the parts become easy, by the inflammation lessening, which is generally about the tenth or twelfth day, the seton is begun to be diminished, when six or eight threads are withdrawn at every dressing; the dressings, consisting of nothing more than a superficial pledget on each orifice, and a discutient cerate, such as the *ceratum saturninum*, to cover the scrotum.

In the treatment of the hydrocele with a seton, I should wish to follow Mr. Pott's method, in every circumstance but the mode of introducing it, which is rendered unnecessarily complex, by the number of instruments proposed for it. In Chapter I. I have described the manner of opening abscesses with a seton, and the directions then given prove equally applicable here.

Let an opening be made with a scalpel, a large lancet, or sharp pointed bistoury, in the superior part of the tumor, large enough to admit, with ease, a cord, consisting of about thirty threads of common white sewing silk. A director, with an eye at one end, *Plate CXIII. fig. 3.* in which the cord is inserted, is to be introduced at this opening; and its farther extremity being carried down to the most depending part of the tumor, an opening is there to be made, half an inch in length, by cutting on the director with the bistoury. The director being now drawn down till a sufficient quantity of silk is left hanging out below, the operation is in this manner finished. In every other respect, the management of the seton should be the same with the method described above from Mr. Pott;

or, instead of introducing the cord with a director, it may be done with a silver canula and perforator, represented in Plate CXIII. fig. 1. 2. and 4.

By making the first opening in the upper part of the tumor, the instrument conducting the seton is more easily introduced along the course of it, than when the first opening is made below; for, in this case, the tumor remains distended to the last: whereas, when opened below, the contents rush out immediately; and the vaginal coat collapses so much about the testicle, that I have known it difficult to get the instrument insinuated between them, by which the testis has, in different instances, been injured; and, by making the under opening half an inch long, any matter which forms in the course of the cure is easily and readily discharged: whereas, in Mr. Pott's method of operating, where the opening is not larger than the size of the trocar, as this is completely filled by the cord, the matter is thereby allowed to collect; an incision becomes necessary, to discharge it; and thus the patient is exposed to pain and disappointment, as I have seen in various instances, where the precaution I have mentioned has been omitted, of making the opening at the most depending part of the tumor sufficiently large for discharging any matter that may form.

Before entering farther into the consideration of the method of cure by the seton, I shall proceed to describe the operation for a radical cure, by incision.

The patient being laid upon a table of convenient height, and properly secured by assistants, with the scrotum lying nearly on the edge of the table, the operator, with one hand, should grasp the tumor behind, so as to hold it firm, and make it somewhat tense on the anterior part of it: with a round edged scalpel in the other, he should now divide the external teguments by one continued incision from the upper end of the tumor, all along its anterior surface, down to the most depending point of it.

If the incision has been properly made, the divided scrotum will retract, and the tunica vaginalis will be laid bare, for the breadth of about half an inch over its whole length. An opening is now to be made in the vaginal coat, just at the upper end of the tumor, where the first incision commenced, and it may be done either with a lancet, or sharp pointed bistoury, or a scalpel. This opening should be of such a size, as freely to receive the finger of the operator; which, being inserted, a probe pointed bistoury is to be conducted upon it, and the sac divided to the very bottom, directly in the course of the first incision. By the previous division, of the skin, with the scalpel instead of the bistoury, the operation is done with more accuracy, and less pain; for the scalpel, from its convexity, admits of a finer edge than an instrument of any other form is capable of receiving, and hence it cuts with more ease.

By making the incision of the teguments and tunica vaginalis together, as in some instances I have seen done, the operation may be somewhat shortened; but the time gained by it is not more than a second or two, while the incision is apt to be ragged and unequal: for, when done in this manner, particularly if the tunica vaginalis is first opened in the most depending part of it, as some have advised, the parts cannot be kept sufficiently tense for completing the incision.

I have desired, that the first opening in the vaginal coat may be so large, as easily to receive the finger of the operator, which ought to be pushed in behind the bistoury, without withdrawing the instrument, as is commonly done. In this manner, we shorten the operation, and, by giving a free vent to the fluid contained in the sac, we prevent it from spreading and forming vesications in the cellular substance of the vaginal coat, and contiguous part, as it is apt to do when the opening in the sac is too small. By making the first opening in the upper end of the sac, much trouble and inconvenience is prevented, which always occur from

making it below. For, as I have before remarked, when the tumor is first opened below, the water is instantly discharged; and, as this is followed by an immediate collapse of the tunica vaginalis, the direction in which it should be cut is not afterwards easily discovered; whereas, by making the first opening above, as the water is thereby gradually emptied on the opening being carried downwards, the vaginal coat continues distended at the bottom, till the whole is finished.

With a view to save some pain to the patient, the late Mr. Hunter advised the incision, both of the scrotum and tunica vaginalis, to be only two-thirds of the length of the tumor; and others have thought even that one half of this is sufficient. But the difference of pain between incisions of these different lengths is inconsiderable, and not to be regarded when compared with the effects that result from them. When the incision is carried the full length of the tumor, the operation succeeds in every instance, if the subsequent part of the treatment meets with due attention; whereas I have known various instances of these partial openings being followed with a return of the disease.

It is particularly proper to carry the incision of the tunica vaginalis, down to the most depending point of the tumor; otherwise the contents of the sac will not be completely discharged, while room will be given for collections of matter during the cure. It is also proper to remark, that, in making this incision of the sac, it ought to terminate at some distance from the testis; for I have, in different instances, observed, where the vaginal coat has been cut near to the testicle, that the inflammation was particularly severe.

The incision being completed, the testicle covered with its tunica albugina, is brought fully in view. In some instances, the testis protrudes from the surrounding parts; in which case, it should be immediately replaced, and covered as quickly as possible from the air; and if no part of the tunica vaginalis is to be re-

moved, the dressing may be finished directly on the sac being opened.

Unless the sac is diseased, or so much distended as entirely to have lost its tone, no part of it, as I have observed above, should be removed: but when hardened to the firmness of cartilage, as I have more than once seen, as, in this state, it is apt to excite pain when applied to the tender surface of the testis, it ought undoubtedly to be removed; and as, in this state, it commonly separates with ease from the surrounding cellular substance, it is easily and quickly cut away with a scalpel or bistoury. The removal of any portion of the sac from the mere enlargement of the tumor, can seldom be necessary; not once in fifty instances.

Hitherto I have been supposing that the disease is confined to one side of the scrotum; but, in some instances, as I have remarked above, we meet with a hydrocele in both sides at once. In this case, the common practice is, to do the operation twice in all its parts, both in the scrotum and tunica vaginalis, by laying each collection open, from top to bottom, by a double incision. Some advise both operations to be done at the same time; but, in general, practitioners are afraid of too much inflammation being induced by this; so that one side is commonly allowed to heal before the other is opened. In this manner, the patient is exposed to delay, uncertainty, and to the confinement arising from two operations.

This, however, is not necessary, as the operation may be done on both sides at once, with little more pain, and, so far as I have seen, with no more hazard, than in the usual method of doing them separately. The method in which I have done it is this:

After finishing the operation on one side, an opening is made into the vaginal coat of the opposite testicle, at the upper end of it, through the septum scroti; and the incision being carried down to the bottom of the tumor, the cyst is thus equally well laid open,

the serum is as completely discharged, and the disease is not more liable to return, than by doing the operation in the usual manner, and at different times.

Whether the hydrocele is double, or confined to one side, as soon as the incision is finished, if the testis is found, the wound should be quickly dressed; and, I think it right to observe, that, on the manner in which this is done, much of the success of the operation at all times depends, more indeed than is commonly imagined.

If the vaginal coat is merely wrapped about the testicle, without the interposition of dressings, or, if the divided sides of it are immediately united with futures, as some have advised, partial adhesions are apt to take place, before a degree of inflammation is produced over the whole, sufficient for rendering the cure complete. In this manner, cavities are left, which either fill with pus during the cure, and require to be laid open, or they afterwards give rise to collections of serum, and thus occasion a return of the disease, different instances of which have fallen within my observation. And, again, the practice of stuffing the cavity of the scrotum with dressings, is also a frequent cause of mischief. By rubbing, or pressing upon the surface of the testis, such a degree of inflammation is sometimes induced, as excites much pain, inflammation, and fever. But this is almost always the fault of the operator; for, in a great proportion of cases, if the dressings are properly managed, no violent symptoms ever occur.

After having tried various ways of dressing the parts, the method I have now long pursued, and which in no instance I have found to fail, is this: the testicle being properly placed in the newly divided sac, two pieces of soft old linen, exactly the length of the cut, previously dipped in a linament of wax and oil, are, by the help of a probe, inserted to the bottom of the sac, one on each side of the testicle, between it and the vaginal coat, care being taken to leave a suf-

ficient quantity of each pledget hanging out of the wound, to admit of its being easily withdrawn at the first dressing; otherwise, if the swelling, which afterwards takes place, shall be considerable, they may, for some days, be entirely covered, and even at last removed with difficulty, as I have seen in different instances where this piece of attention has been omitted.

If the testicle has pushed forward, and is with difficulty retained in its situation, as it will be apt to slip out between the lips of the wound between one dressing and another, no means should be omitted that can with safety be employed for preventing it, as it cannot afterwards be so easily replaced; and, from want of attention to this, I have known the testicle entirely extruded from the scrotum, and in one instance, from sufficient pains not being taken to replace it, the cure was completed with the testis in this situation; when, instead of being covered with the vaginal coat and scrotum, it was covered with scarf-skin only.

The best method of preventing such a misfortune, is, to draw the edges of the divided tunica vaginalis and scrotum nearly together, after the testis has been properly placed, and the pledgets of oiled linen inserted; and, in this situation, to secure them, either with two or three futures, at proper distances from each other, or with slips of plaster, sufficiently adhesive for retaining them.

This being done, the whole scrotum is covered with a large pledget of saturnine cerate, or common wax ointment, by which the parts are kept much more soft and easy, than when dressed, in the usual way, with dry lint, at the same time that the dressings are much more easily removed. A cushion of soft tow, with a proper compress, is placed over the pledget of ointment, and the whole are retained by the T bandage, or common suspensory bag. The patient is now carried to bed: a quieting draught should be given; and he should be enjoined to remain as much as pos-

fible in the same posture ; for much motion at this period certainly does harm.

The intention of this operation being to induce a moderate degree of inflammation in the tunica vaginalis and surface of the testicle, if the pain, inflammation, and swelling, which, in some degree, always succeed, do not run to a great height, nothing is to be done for the first two or three days after the operation ; but, when these symptoms become violent, and especially when much fever is induced, means must be employed to lessen or remove them.

The remedies we chiefly depend on, are bloodletting, gentle laxatives, a low cooling diet, and warm emollient poultices and fomentations to the part, in order to forward a plentiful suppuration, which commonly tends to moderate every bad symptom more effectually than any other remedy. By these means, the inflammation is in general easily kept within proper bounds ; but where the mode of dressing I have pointed out is adopted, they are not often required. In a great number of cases, in which I have done the operation in this manner, I have only once found it necessary to advise bloodletting, and very rarely fomentations or poultices.

In most cases, the inflammation of the testicle does not rise higher than in the simple hernia humoralis from gonorrhœa ; and it gradually subsides as the suppuration advances. The abatement of the inflammation is also assisted by continuing a cool diet, the occasional use of opiates, and keeping the belly open.

Often in two days, and always by the end of the third, I remove all the dressings, except the pledgets inserted between the testis and tunica vaginalis. This is one important advantage we derive from covering large fores with pledgets of ointment. The dressings are easily removed at any period ; so that, without waiting for a plentiful suppuration, as is commonly done, the patient may, at any time, be relieved from that distressful uneasiness, of which all those complain

in whom the first dressings are several days in being taken away. They are always rendered stiff and uncomfortable, by the blood discharged upon them after the operation; and the matter at first secreted being thin and acrid, I have, in various instances seen, when the dressings have not been removed for six or seven days, and in some cases even in less, that the whole contiguous parts have been excoriated by the acrimony of the matter alone, and by which more uneasiness has been induced during the course of the cure, than by any other circumstance connected with the operation: nay, in some, the inflammation induced in this manner has an obvious influence on that of the testicle, and tends to render it much more severe than it otherwise would be.

On some occasions, at the first dressing, and always at the second or third, the pledgets inserted between the tunica vaginalis and testicle come away; and whenever this happens, they should be renewed. It is also proper to renew them daily, for the first fourteen or fifteen days after the operation; not, however, of the same depth as the first, as, during the latter part of the cure, it proves sufficient, if they are merely inserted so far as to prevent the divided edges of the tunica vaginalis from adhering to the testicle before the adhesive process has taken place in the parts more deeply seated. To this point, I must observe, the most particular attention is necessary; for, when this mode of operating fails, that is, when the disease returns, it is, almost in every instance, from this precaution being overlooked. In my own practice, the disease has not returned in a single instance: but I have met with different cases in which it has done so, and in all of them from the cause I have mentioned, to wit, the divided edges of the tunica vaginalis being allowed to adhere to the testicle, before adhesion had taken place between the parts more deeply seated.

In almost every circumstance, the treatment of hydrocele by this operation is the same with what an-

fers best in a common abscess. After opening an abscess, if the lips of the newly divided parts are allowed too early to adhere, either to each other, or to the parts beneath, the operation will most probably fall to be renewed, as matter will thus be allowed to collect, by which the patient will be nearly in the same situation as before ; while all manner of risk of this is prevented, by the cut being kept open till the sides of the abscess adhere to each other. In like manner, we never fail in the cure of hydrocele, if the external cut is kept open, not till the cavity of the tunica vaginalis fills up with granulations, as some have imagined to be necessary in this mode of operating, but merely till such a degree of inflammation is induced upon the testicle and vaginal coat, as terminates in their adhesion to each other.

This idea of the whole cavity of parts in this situation being to fill with new granulations, has been held out by some as an objection to this operation ; and as many believe that it actually happens, I have judged it proper to speak of it more particularly than those will consider as necessary, who have been accustomed to operate in this manner. No such process takes place : instead of it, the testicle and vaginal coat, soon after the operation, become inflamed ; till the sixth or seventh day, the inflammation continues gradually to increase, when the whole tumor, as I have observed above, has acquired the usual size and appearance of a common hernia humoralis from gonorrhœa. About this period, the tunica vaginalis is found to adhere to the testis, over all the posterior and lateral parts of the tumor, and on the slips of oiled linen being gradually lessened, and at last withdrawn, by the fourteenth or fifteenth day, or soon thereafter, the adhesion becomes complete ; the tumor of the testis gradually subsides, and the sore produced by the cut, and now reduced to a line, heals in a shorter or longer time, according to the habit of body, age, and other circumstances of the patient. In some, the cure is

complete in three weeks ; I have known it in less ; while, in others, it runs on to the fourth, fifth, and in a few cases, to the sixth week.

Having thus given an account of the different operations usually employed for the radical cure of the hydrocele, I shall now make a few observations on the comparative advantages of the three last, to wit, those by caustic, the seton, and the simple incision ; one or other of these being now commonly practised for the removal of this disease.

From the testimony of many respectable authors of the efficacy of each of these, there is no reason to doubt that any of them would, in most instances, prove effectual : that the caustic, when properly managed, will for the most part succeed, we have every reason to believe ; and the same may be safely asserted both of the seton, and the simple incision ; but every practitioner being apt to be prejudiced in favour of a particular method, he generally continues to practise that mode, and no other ; and finding that it commonly succeeds, he by degrees comes to persuade himself, that other methods of cure, with which he has not had such opportunities of becoming acquainted, are liable to objections, which those who have practised them do not find to be the case.

I happened to attend the hospitals in London, about the time that Mr. Pott's publication on the seton, and Mr. Else's treatise on the cure of the hydrocele by caustic, were published ; when, of course, the various means of curing the disease were frequently the subject of medical conversation. I was thereby induced to pay much attention to the subject ; and having the advantage of seeing the practice of different hospitals, and not being particularly biased in favour of any particular method, I was thus furnished with the best opportunity that could be wished for of forming an opinion : and the result of all the observation I was either at that time able to make, or since that period, both in the hospital here, and in private practice, is,

that although all the three modes of operating, by caustic, the seton, and simple incision, are perhaps equally capable of producing a radical cure; yet that of the three, the latter, to wit, the mode by the simple incision, is liable to fewest objections, and effects a cure both with least trouble to the operator, and least risk to the patient: and, of the other two, the treatment by caustic appears to me to be the best.

I have seen all the three produce troublesome symptoms, such as pain, and tension of the abdomen, inflammation, and fever; but, from much observation, I can, without hesitation say, that the seton is more frequently productive of these than either of the others; nor need we wonder at this being the case; for the cord which is here introduced, lying in close contact with the body of the testis, must necessarily occasion a considerable and continued irritation, as long as it remains applied to it.

The seton is likewise attended with other inconveniencies, to which neither of the others, when properly managed, are liable. When the inflammation, which succeeds to the introduction of the cord, runs high, as it frequently does, it commonly terminates in such a plentiful suppuration, that the matter produced by it cannot be readily discharged at the opening made for the seton. In consequence of this, it finds access to the neighbouring parts; and different abscesses are accordingly formed, which must all be discharged by as many openings. This may, in part, be obviated, by making the inferior opening of the size I have directed; but, in some instances, I have found even that this has not proved sufficient, owing to the opening being reduced in size by the swelling and inflammation of the tumor.

Another objection to this operation, which I think of importance, is this: it does not admit of free examination, either of the state of the testicle, or of the fluid contained in the sac. I know that in a simple uncomplicated hydrocele, the state of the testicle re-

quires no examination ; nor would we think of removing it, either on account of a mere enlargement, or diminution of its size, provided it is not otherwise diseased. But we know well, that cases sometimes occur, which elude the utmost skill and penetration of the surgeon ; no diagnostic symptoms, with which we are yet acquainted, being sufficient to direct us with absolute certainty.

The most experienced practitioner will admit, that at times, he has been mistaken in his opinion respecting the nature of such tumors ; a real sarcocele, or scirrhous testicle, attended with some effusion of a fluid, being in some instances, mistaken for a pure unmixed hydrocele ; and vice versa, a simple uncomplicated case of hydrocele has been mistaken for, and treated as a scirrhous testicle. Such occurrences every practitioner must have met with ; and among others, who confess their having been deceived in this manner, a very candid acknowledgment is made of it by Mr. Pott ;* and Mr. Else takes notice of a similar occurrence in which he was concerned.

I have been concerned in different cases, where the most experienced surgeons were at a loss to determine the real nature of the disease ; that is, whether the swelling in the scrotum was a simple hydrocele of the vaginal coat, or an effusion of a fluid into that bag produced by a scirrhous testicle. In all such cases of doubt, the surgeon should proceed as if the tumor was a real sarcocele. If, on laying open the swelling, the testicle is found diseased, that is, if it is in such a state as to require extirpation, it should be removed immediately ; while, on the contrary, if it appears to be sound, he will treat it as a case of simple hydrocele.

* Treatise on the Hydrocele, p. 288. In this case, which, from every circumstance, had been considered as a sarcocele, the testis, after being removed, was found to be perfectly sound, the disease being a real hydrocele of the tunica vaginalis.

The mere possibility of such an occurrence with such an attentive observer as Mr. Pott, ought to serve as a most convincing argument with practitioners of the necessity of proceeding with the utmost caution in all such cases, where there is the least cause for doubt.

In several instances of this kind, where, by different practitioners, a mere collection of water was expected without any other affection, the testicle has been found to be so much diseased, as to render immediate extirpation proper. Now, if in such circumstances a cure had been attempted by the seton, the testicle would have been allowed to remain exposed to the irritation produced by the cord, which probably would have induced very troublesome and even alarming symptoms ; for we know that every symptom of a schirrous tumor, is uniformly rendered worse by irritation.

It has indeed been alleged, that the real state of the testis may be always known, by drawing the water off from the tunica vaginalis with a trocar ; and this has accordingly been recommended as a previous step to the introduction of the seton, with a view to ascertain the state of the testicle. But it often happens, even after all the water is drawn off, that the thickness produced by the vaginal coat and scrotum collapsing in large folds about the testis, precludes effectually every accurate examination of this kind. Of this, where the tumor has been large, every practitioner must have met with instances ; and we need not be surprised at its being so, when it is known that instances occur, in which it requires a good deal of experience to determine, whether a testicle is so much diseased as to require extirpation, even when completely laid bare in the common operation for the hydrocele. Of this I have known several cases in which a difference of opinion occurred, even among surgeons of observation ; and among these, the most remarkable happened in an operation performed by a late very eminent surgeon. The case was supposed to be a schirrous testicle connected with the effusion of a considerable quantity of a fluid into the tunica vaginalis. On laying open the tumor, the testicle was found enlarged and hard ; but being neither painful nor unequal on the surface, the operator thought it improper to remove it : the surgeons present were of a different opinion ; but the

event of the case, which was favourable, tended to evince the superior judgment of the operator, although, previous to the operation, he had entertained a very different opinion.

I have also observed above, that when the seton is used, the contents of the cyst cannot be properly ascertained. It sometimes happens, as will be more particularly noticed in the next section, that a portion of gut is contained in the upper part of a hydrocele. Of this I have met with several cases, in some of which no suspicion was entertained of it, till the sac was laid open, although in two of them the water had previously been drawn off with a trocar.

In other instances, the water of a hydrocele is contained in hydatids;* a circumstance not to be discovered previous to the opening of the tumor: and as it will be readily admitted that the method of cure by seton is ill suited for discharging hydatids, this of itself is a material objection to the practice; so that, although the seton, in every other respect were equally eligible with the simple incision, which, for the reasons formerly given, I think it is not, yet the three last objections that I have adduced against it, seem to be sufficient reasons for setting it aside.

With respect to the mode of treatment with caustic, I have only to observe, in addition to what has already been said of it, that where patients are naturally timid, and do not incline to submit to the operation by the knife, this may be put in practice.

But the method of cure by caustic is liable to one important objection, which never attends the cure by incision, to wit, that of being productive of sinuses, and collections of matter, in the scrotum and cellular substance connecting that bag to the tunica vaginalis. Two instances of this I have seen, in which it was necessary to discharge collections of matter by different

* Those who doubt of the existence of hydatids in cases of hydrocele, as some have done, will find different instances of them recorded in Morgagni de Causis et Sedibus Morborum.

openings ; and a remarkable case of it is related by Douglas, in which an extensive incision became necessary for removing the collected matter.* For this reason, therefore, and as the method of cure by incision brings the state of the testicle immediately and more completely into view, and especially as, from all the experience I have had of the two different modes of operating, that by incision seems to produce the least troublesome symptoms, I am decidedly of opinion that it should be preferred.

In points of such importance, no person should form any opinion hastily. Nothing but various opportunities of putting the different operations in practice, can enable any one to judge of the merits of each. Even in the writings of the late celebrated Mr. Sharpe, we find a remarkable instance of this. In his treatise on the operations of surgery, he speaks of the radical cure of hydrocele, whether by caustic or incision, or in whatever way it is done, as a very dangerous operation, and seems to think that it will be entirely laid aside.†

At that time it is evident that Mr. Sharpe's experience in this disease was not sufficient to warrant a decisive opinion. It proved to be contrary to the direct experience of some of our best surgeons ; and Mr. Sharpe himself seems afterwards to have been convinced that his first ideas of it had been ill founded.‡ Still, however, his first opinion had much influence with a great proportion of surgeons ; so that, till of late years, the radical cure of hydrocele was seldom attempted but in large hospitals : and when at last it was found that the danger attending it was less than had been represented, still, the terror induced by Mr. Sharpe's account of the mode of operating by incision, was such, that almost all who wrote upon it, were afraid of advising it to be so generally performed as it ought to be.

* P. 105.

† Tenth Edition, Chap. IX.

‡ Vide Critical Inquiry, first edition, p. 86.

When the earlier editions of this work were published, although I gave the same opinion of this operation that I have now done, and of the preference to which it appeared to be entitled, and although my experience of its utility and safety had at that time been considerable yet, finding it spoken of with much caution by many, and among others by Mr. Pott, I did not venture to recommend it so warmly for general use, as I am now by much additional experience enabled to do. Although I had performed the operation in a great number of cases, without losing a patient, yet, as in some the inflammation came to a considerable height, I was afraid that in others the dreadful accounts that were given of it by authors might occasionally be realized. This induced me not only to speak of it with caution, but to endeavour, if possible, to discover the cause of the violence of this symptom; for it obviously appeared, not merely from my own observation, but from all the accounts which had been given of this operation, that the danger attending it was always in proportion to the degree of inflammation; and therefore, if this could be rendered moderate, that little or perhaps no hazard would ensue from it.

I did not find that the length of the incision had much influence; for, whether it was to the full extent of the tumor, or only to one-third of that length, the inflammation appeared to be the same. Some advantage indeed was derived from attending to the direction of the incision; for, wherever it was carried too near the testicle, as is sometimes done at the bottom of the sac, the pain and inflammation were always severe; but the most frequent cause of the violence of these symptoms appeared at last to be the mode of dressing the parts after the operation. It had commonly been the practice to cram a considerable quantity of dressings into the cavity of the tunica vaginalis; and, with a view to make the surface of the parts slough quickly off, a process which at that time was

judged necessary for the cure, red precipitate and other irritating substances were made use of by many. The impropriety of these being obvious, dry lint was, by Mr. Pott and others, proposed to be used instead of them. This was an important improvement, and it tended more than any other circumstance to lessen the dread that had been conceived of this operation by the writings of Mr. Sharpe. Still, however, the inflammation run in many instances too high; the parts swelled to a great size, and the patient, for the first two or three weeks of his confinement, was often kept in much distress and anxiety.

Having frequently found that the dry lint inserted into the tunica vaginalis, adhered, at the first dressing of the parts, so firmly to the surface of the testis, that it could not be withdrawn, I at last began to conclude that this might render the inflammation more severe than it otherwise would be; and it soon appeared that my conjecture was well founded. For several years past I have covered the pledgets applied to the surface of the testis, as has been advised above, either with fine oil, or with a thin linament of oil and wax, which answers better. This gives much less pain, in the first instance, than dry lint, and the pledgets never adhere to the contiguous parts; so that they can be as easily removed at the first dressing of the sore, as at any future period of the cure.

The effect of this, and of proceeding in the other parts of the treatment, in the manner I have mentioned, has been, that during all this period the inflammation has never gone farther than I could have wished it to do; never so far as to excite the least cause of anxiety. The testicle swells and inflames, but in no greater degree than is necessary for preventing a return of the disease. Of this the clearest proof that can be given, is, that of upwards of one hundred and fifty patients on whom I have operated in this manner, I have only once found it necessary to advise blood-

letting; and very rarely, as I have formerly observed, fomentations or poultices.

I may further mention one important advantage of this operation, in addition to what I have said of it, that it may be considered as absolute security against a return of the disease. I have known indeed two instances, and I have heard of other two in which the disease returned after this operation was performed. But these are all the instances I can hear of its failure in the course of these last twenty-five years; and in all of them the cause was evidently traced to want of that persevering attention during the cure, so necessary for the success of every operation, and particularly for that of the hydrocele.

That this operation is not hazardous, and that it may with confidence be relied on against future returns of the disease, I am warranted in asserting, not only from the universal success attending it in this country with others, but from the success arising from it in my own practice.

Almost every operation that had been proposed for the cure of hydrocele, had, by one or other of our surgeons, got a fair trial; to wit, that by excision or cutting away the greatest part of the tunica vaginalis; by injecting wines and other liquids into the cavity of the sac; by irritation, excited with tents of various kinds, both solid and hollow; and more lately by the seton. But, however keenly one and all of these methods had for a time been supported by those who first introduced them, they were at last entirely laid aside; so that, for these last five years and more, scarcely any has been attempted through the greatest part, or perhaps the whole of Scotland, but that by incision: and although, as I have observed above, I have been able to trace a return of the disease in four instances, all of them from causes which ought not to have occurred, not one, so far as I know, has died of the operation.

I have now performed this operation in a very large number of cases, and in every variety of age, from

the third to the seventy-fifth year: not one of the number has either died or been in danger; nor has the disease returned in any of them. In various instances, at first, the inflammation, as I have observed above, arrived at a considerable height; but not in a single instance, since the operation has been done in the manner I have mentioned.

I have therefore no reason to doubt of the objections which have been made to this operation, being soon done away, and I also believe, that the more it is put in practice, the less dread will be entertained of it. For my own part, I now consider it as a matter of nearly the same simplicity as the treatment of a common abscess in any part of the body. The cure is conducted upon the same principles. It is accomplished in the same time; commonly in less than the cure of abscesses of equal magnitude; and, from the event, I am warranted to say, that it is not attended with more hazard.

Others, from not being so fortunate, and with whom a high degree of inflammation was often induced, not conceiving that this inconvenience could be lessened, either by any alteration to be made in the mode of performing the operation, or in the management of the dressings, were naturally induced to make trial of other means of obtaining a radical cure of the disease.

The late Mr. James Rae of this place, who was perhaps one of the best informed practitioners, as I believe him to have been one of the best operators of the age, was I believe, the first who revived the use of the seton in this kingdom for the cure of the hydrocele. He, as well as Mr. Pott, who afterwards wrote upon it, having from the causes I have mentioned, conceived a dread of the mode of operating by the simple incision; and Mr. Rae having previously made many unsuccessful trials of the method of cure by injecting wine and other liquids into the tunica vagina-

lis testis, they both keenly adopted the practice with the seton. Being strongly recommended by two surgeons of such reputation, it was at first adopted by others; but the inflammation induced by it was found in some instances, to be so great and alarming, and the distress arising from matter collecting within the tunica vaginalis, and from the openings necessary for the discharge of it, was so considerable, that the practice never got into general use; and it now appears to be laid aside even by those who at one period had formed the most favourable opinion of it. I have not heard of its being performed in a single instance in this place, for these last twenty years: it seems to be falling into disuse in England; and although in some parts of the Continent it was at first adopted, on the recommendation of Mr. Pott, I do not now learn that it is ever attempted.

About the same period that Mr. Pott wrote upon the use of the seton, the late Mr. Else began to revive, with some improvements, the method of curing the hydrocele with caustic; and if any sufficient reason had occurred for laying aside the operation by the simple incision, I would have been of opinion that the method of cure recommended by Mr. Else, should have been preferred to every other with which we are yet acquainted. It gives much less pain than the seton, and it cures the disease with equal certainty.

The method of cure by excision, that is, by cutting away the tunica vaginalis, cannot be compared to that by the simple incision; for it does not accomplish a cure more quickly, nor with more certainty, while it obviously renders the operation much more tedious and more painful, the chief reasons, no doubt, for this mode of operating being now very generally exploded.

The last variety of operation that has been recommended for the cure of hydrocele, is also the revival of an old one, to wit, the injecting of wine and other liquids into the tunica vaginalis testis.

The merit of first proposing the cure of this disease by injections, has commonly been given to a Mr. Munro, a surgeon of this country; but we now have evidence of the practice having been proposed and adopted upwards of fifty years sooner. Tents, armed with irritating ointments having long been employed, we need not wonder at injections being considered as a better method of conducting the same remedies to the parts upon which they were to act. Whether injections were earlier used for this purpose or not, we do not certainly know; but in 1677, there is a third edition of what is intituled *Les Oeuvres Chirurgicales*, of a Monsieur Lambert at Marseilles, in which a particular account is given of the method of curing hydrocele by injections. The liquid Mr. Lambert preferred, was a strong solution of corrosive sublimate, in lime water; and he enumerates many cases in which it proved successful. But whether from the pain which it excited being severe, or for other reasons with which we are not acquainted, this mode of operating appears to have been for a long time laid aside, till it was afterwards practised by Mr. Munro. He at first made use of spirit of wine; but although it cured the disease, the pain which it excited was so severe, that he immediately laid it aside, and employed wine instead of it.

The practice being favourably received by some of the first surgeons of this place, particularly by the late Dr. Monro, Mr. Douglas, Mr. Lauder, and the late Mr. Rae, it was for some time frequently practised, especially by Mr. Douglas and Mr. Rae. The liquids they employed were diluted spirit of wine, lime water, a solution of alum, and red wine, both by itself, and diluted.

But however favourably they were at first induced to judge of the practice, and although very anxious for its success, it was in the course of a few years, laid aside by all of them, and evidently upon good grounds. The injection either excited severe pain, on being first

thrown in, and was succeeded by violent inflammation, and this, in some, by distressful collections of matter ; or the cure did not prove permanent. In a few cases, the disease returned almost immediately, that is, in the course of two or three weeks ; but this was not frequent. For the most part, the cure appeared to be complete, and continued to be so, till at some distant period, to the great disappointment both of the patient and surgeon, a recurrence of the swelling was observed. In some, this happened in five or six months ; in others, not till three or four years had elapsed.

About the same period, some unsuccessful trials being made with injections in London, both by the late Mr. Sharpe and others, the practice was altogether laid aside there, as it had been here, till of late that some attempts have been made to revive it.

But although for a period of more than forty years, this operation was scarcely heard of in Britain, it was frequently practised in France, and other parts of the Continent, where many trials and experiments were made for curing the hydrocele by injections. Trials were made with spirit of wine, both by itself, and diluted with water ; with a solution of common caustic in water, in the proportion of two grains to the ounce ; with blue vitriol in water, in the same proportions ; with lime water, both by itself, and with mercurius sublimatus corrosivus dissolved in it in various proportions, from a quarter of a grain to two grains, to the ounce ; with strong solutions of alum, of saccharum saturni, infusions of red rose leaves, infusions of oak bark, and with red wine, both by itself, and reduced with water to various degrees of strength, according to the fancy of the operator.

Many give the preference to an infusion of red rose leaves : others make use of the corrosive sublimate ; but it requires, even when much diluted, to be used with great caution. In general, the preference is given to wine : when claret or burgundy are employed,

they are commonly mixed with a sixth or seventh part of water ; and when port is used, a third or fourth part of water is added. Where no pain is excited by the injection thus diluted, the liquid should be discharged, and pure wine thrown in ; for where no pain takes place, a cure is not to be looked for.

The operation is done in different ways ; some preferring a lancet for making the opening into the tumor, and others injecting the liquid with a common syringe ; but in my opinion, the best method of performing it is the following.

The surgeon should be provided with a flat trocar, of the form and size represented in Plate LVIII. fig. 3. together with a bag of *resina elastica*, fitted with a pipe, represented in the same plate, fig. 1. The pipe should be somewhat longer than the canula of the trocar, so as to pass about an eighth part of an inch beyond it. If longer than this, it might injure the testis ; and when shorter, the liquid does not pass so easily. The quantity of liquid to be injected should be gently warmed, and put into the bag before the operation is begun. The patient being laid in a horizontal posture, either upon his bed or on a table, and secured in the usual way by assistants, the water should be drawn entirely off from the tumor, by passing the trocar into the anterior and most depending part of it. The operator, securing the canula of the trocar with his left hand, is now with his right, to pass the tube of the injection bag entirely through it, and with gentle pressure, to force as much of the liquid which it contains into the cavity of the tunica vaginalis, as may be necessary for easily reaching every part of it, as well as the whole surface of the testis. The bag should now be removed, taking care to leave the tube within the canula of the trocar, so that by turning the stop cock, the liquid may be retained in the cavity of the tumor. The surgeon should still keep the canula of the trocar fixed, otherwise it might recede, by which the liquid would insinuate into the cellular substance

of the scrotum, and in this manner do harm. He should also, with very gentle pressure, make the liquid pass to every part of the cavity during the time it is retained in it; and at the end of four minutes, it should be entirely discharged through the canula of the trocar, after withdrawing the tube of the elastic bag.

Some have said that the injection should be retained about three minutes: others think that it cannot be depended on in less than six or seven. But those who have operated most frequently in this manner, are of opinion, that the space of four minutes is better than either. It sometimes happens that intense pain is given almost instantaneously on the injection being introduced. In this case, it should be discharged as soon as it has been made to pass to the different parts of the tunica vaginalis.

Some again are of opinion, that after the quantity of liquid first injected is discharged, a similar quantity should be immediately thrown in, and retained for the same length of time, and that the operation will be very apt to fail if this is omitted. This however, is seldom done, although I believe it would be a real improvement on the operation.

The quantity of liquid to be injected, should always depend on the size of the tumor. Some have thought that it should be equal to the quantity drawn off by the operation; but this does not appear to be necessary, while the injecting of such a quantity is apt to do harm. After having collapsed completely, the parts do not again yield easily to sudden distention; so that violent pain has been induced by it. Where the tumor is small, that is, where only five or six ounces of serum are collected, the quantity of injection need not exceed three or four ounces; while it should not be less than seven or eight ounces, where a pound of serum has been drawn off; and in this proportion, according to the size of the tumor.

Less than any of these quantities might answer ; but it would require more handling to bring it into contact with all the parts which it ought to touch ; and as a larger quantity is easily introduced, it should always be advised.

On the injection being discharged, and not a drop should be left, the scrotum should be covered with a pledget of common cerate, a compress being applied over it, and retained with a suspensory bag. The patient should be desired to remain in bed for several days, and to give aid to the suspensory bandage, by inserting a small pillow beneath it.

It often happens, that the pain is inconsiderable from the first ; scarcely any inflammation or tumor being perceived on the testis ; and the patient, considering himself as well, walks abroad, in ten, twelve, fourteen, or fifteen days. But, with others, a very severe degree of pain takes place on the first introduction of the injection, not merely in the testis, but in the back, and over the whole loins. In most instances, this soon becomes moderate, and the treatment goes easily on ; but, in others, it is succeeded by great inflammation in the testis and scrotum ; and, in a few, this terminates in collections of matter within the cavity of the tunica vaginalis.

These violent symptoms the practitioner endeavours to obviate by bloodletting, a low diet, the use of laxatives, and all the remedies usually employed in hernia humoralis ; such as all the saturnine applications ; and warm emollient fomentations and poultices, when suppuration is likely to take place.

When matter forms in the tunica vaginalis, the treatment consists in laying the collection open from one end to the other, and conducting the cure, as has already been advised in the operation by the simple incision. The formation of matter, I believe, is not frequent ; but I know that it occasionally happens ; and so much are the practitioners on the Continent afraid of it ; of the height to which the inflammation might

otherwise advance ; and of the dreadful distress that in such circumstances ensue, from suppuration taking place, that they seldom perform the operation without premising purging and bloodletting, and often repeat the bloodletting once and again during the cure, precautions never judged necessary in the method of curing the hydrocele by the simple incision.

The proportion of those that are radically cured by this method of operating, it is difficult to ascertain ; for, although in some the disease returns in the course of two or three weeks ; in others, it is not perceived for several months ; and, in some, as I have observed above, not till two or three years have elapsed. Hence, in hospital practice, where patients are seldom heard of after being dismissed, the point in question cannot be determined ; and it is chiefly in foreign hospitals that hitherto this operation has been performed. From the best information that I have been able to procure, it appears, that although, in many, a complete cure is obtained, yet that the disease returns early, that is, in the space of a few weeks, in a ninth or tenth part of all on whom the operation is performed ; and in five of eight or nine, at some uncertain period in future.

Under this conviction, I have judged it proper to state all that has come to my knowledge of what relates to this operation ; and I am the more induced to it, from finding that others, either from an unnecessary dread of the operation by the simple incision, and which I consider as the best and most rational that is yet known, or from a misrepresentation in the accounts they may have received of the method of cure by injection, are again endeavouring to introduce it in Britain.

From the history that I have given of the method of curing the hydrocele by injections, the conclusion that I have formed of it would readily be drawn by any one ; but, in addition to this, many powerful arguments may be adduced against it.

1st, We do not, from experience, find, that other tumors, produced by fluids contained in cysts, are readily cured by injections. Few, I believe, would now think of attempting the cure of abscesses or encysted tumors by injections. In tumors induced by fluids collected in the *bursæ mucosæ*, where, from the contiguity of joints, extensive incisions might have done harm, I have in various instances, made trial of injections; but seldom with any advantage. In some, they excite pain and inflammation; and where this does not happen, although they may lessen the discharge, this proves only temporary; so that a cure is afterwards to be obtained by the introduction of a cord, or the enlargement of the opening to as great an extent as with safety can be ventured upon.

Mr. Earle, indeed, has said, and he gives it as a reason for the practice he has adopted in hydrocele, that he has frequently succeeded in procuring adhesion and consolidation of parts in sinuses, and other large cavities, by injections of various kinds: but, as this has neither happened in the course of my own experience, nor with any other practitioner with whom I am acquainted, I must leave the practice in the hands of those with whom it has answered better.

At one period, a practitioner in this country got into notice, by announcing frequent cures of the fistula in ano as well as other sinuses, by injections. Some timid patients, both here and from England, put themselves under his care. His reputation, however, was not of long duration; for I do not find that he proved successful in one of twenty cases, although the patients commonly remained long under his care. The injections were thrown in frequently, and with much attention; and liquids of various kinds were employed; some that seemed to act solely by their astringency, and others by exciting inflammation.

2d, When the tunica vaginalis has been much distended, as it will not collapse equally round the testicle on the fluid being drawn off, cavities will thus be

formed, by which separate collections will be apt to take place, either of a serous fluid, or of purulent matter, if inflammation has been excited. This was my opinion of the probable effect of injections, long before the last edition of this volume was published; and since that period, different cases have occurred, which render it certain that the suspicion was well founded.

3d, When inflammation, excited by an injection, goes too far, and with whatever care the operation is done, it sometimes happens, the distress produced by it is severe. Besides the pain arising from the inflammatory stage of the disease, if suppuration takes place, the patient must submit to that painful distention which the sudden formation of matter in this confined state always excites; to the febrile symptoms with which it is attended; and to an incision equally extensive for discharging the matter, as if the mode of cure by incision had been adopted at first.

4th, The state of the testis cannot, in this mode of operating, be examined with the same accuracy, as when the operation is done by incision. Hence it may be in such a state of disease as to be injured by the injection, without our being previously able to discover it.

Some indeed have said, that, on the water being drawn off, we may always know with certainty whether the testicle is sound or not. This when it is much enlarged, is certainly the case; but where the tunica vaginalis is thickened, as it generally is when it has been long much distended, the testis, if not considerably enlarged, as well as the epididymis, may be materially diseased, without our being able to discover it. Of this I have seen various instances; in some of which, as I have observed above, practitioners of much experience were deceived.

5th, The views of modern surgeons in the cure of the hydrocele, are, as I have already had occasion to remark, to excite such a degree of inflammation over

the surface of the testicle, as well as of the tunica vaginalis, as may produce a firm adhesion between them.

Now, instances often occur, in which the tunica vaginalis is so thick, callous, and insensible, that a much more irritating injection would be required to make it inflame than the testicle itself can bear.

Nay, cases are sometimes met with, in which different portions of the tunica vaginalis are as firm and hard as cartilage; a state highly improper for any attempt to cure the disease by injections, or in any other way than by removing the hardened parts; and yet this sometimes happens, as I have more than once seen, where previously it could not be discovered, and in which the tunica vaginalis testis appeared to be in its usual state, till the contrary was found to be the case, on laying the parts open by simple incision.

6th, The chief, and perhaps only advantage which the mode of operating by injection seems to possess, over that by incision, is, that it is less painful in the execution; but although this may be a reason for advising it with timid patients, who will not submit to the other, it is not sufficient to warrant practitioners in giving it the preference. The prevention of pain is at all times a most desirable object; but it is far from being the only one in surgical operations. Our chief view, is the safety of our patient in the first instance, together with his complete security against a return of the disease. In so far as one mode of operating is less painful than another, and attended with equal certainty in securing against a relapse, it ought certainly to be preferred; but this is, as I have already had occasion to remark, far from being the case with the mode of curing the hydrocele by injections; so that patients treated in this manner, are, for a considerable time, liable to all the distress and anxiety, which uncertainty in points of importance in every instance gives, while the chief difference between it and the method of operating by incision, which I have shewn to be attended with complete safety as well as security,

consists in the degree of pain which it excites being less. This of itself would have little influence even with the most timid, were they to know, that, in the mode of operating by incision, the cutting part of it is done in less than a minute; when the dressings are properly conducted, that the testicle does not inflame more than is necessary for a cure; and that the subsequent pain is for the most part inconsiderable; not to be compared with what is experienced from matter collecting within the cavity of the tunica vaginalis, as sometimes happens in the mode of operating by injection, as well as in that by the seton.

7th, As an argument in favour of this operation, it is said, that when it fails, we still have it in our power to perform it over again, or to advise the radical cure by incision. This, however, leads to much vexation, distress, and disappointment in the first instance, while I think it probable, that one effect of injections, when they do not succeed, must be to render any other operation that may be afterwards performed more uncertain than it otherwise would be, or to require a higher degree of inflammation to be induced. Some have imagined, that injections in the cure of hydrocele prove useful, only in so far as they excite inflammation, and consequent adhesion of the tunica vaginalis to the surface of the testis; whilst others are of opinion, that they act solely by their astringency. By strengthening or corrugating the secreting and absorbent vessels of the parts, they may be supposed to act both by preventing a too plentiful secretion of the fluid naturally contained in the tunica vaginalis, and by promoting a more equal absorption; and we accordingly find, that such fluids only are now used for these injections, as are in a considerable degree astringent, such as infusions of red rose leaves, solutions of alum, and red wine.

My own opinion is, that a permanent cure is never to be depended on, where inflammation is not induced sufficient to produce a firm adhesion between the

tunica vaginalis and testis ; but there is reason to think, that this seldom takes place from injections ; and I conclude that it is so, not only from the trifling degree of pain which, in most instances, the injections now used commonly give, and from the swelling of the parts, which usually takes place, being inconsiderable, but from the disease often returning, after it had been supposed to be cured, and which could not happen, if these parts had been made to unite by inflammation.

Now, if this is the fact, and I firmly believe it to be so, that injections, in a great proportion of cases, act chiefly by their astringency, and not by destroying the cavity of the tunica vaginalis, they may readily be supposed to render, not only the tunica vaginalis, but even the surface of the testis more callous than it was before, by which a greater degree of inflammation will be required, than might otherwise be sufficient, when any other operation becomes necessary for a permanent cure.

In answer, however, to all these objections, it may be said, that the practice has already gained ground in several parts of the Continent, and that Mr. Earle, a surgeon of our own country, has brought forth two publications on the subject, in both of which it is recommended in the warmest manner, and a number of cases recited, in which it appears to have proved successful.

To this I shall only observe, what I have already had occasion to do, respecting the practice of foreigners in the hydrocele ; that having been later than the British surgeons, in acquiring a knowledge of the true nature of the disease, they have hitherto remained behind them in every thing that relates to it. Their practice has therefore been timid, changeable, and indecisive. This, however, I only mean as a general observation ; for some foreigners there are, whose knowledge in this, as in all other diseases, would do them much honour : but all who have read what in gener-

al has been written upon this subject by foreign surgeons, or who have had opportunities of seeing their practice, must admit, that in the treatment of hydrocele they ought not to be followed.

And again, with respect to the observation of Mr. Earle, I need only observe, that this writer obviously labours under a deep rooted prejudice against every mode of operating, except that by the seton, of which he once seems to have entertained a very high opinion, and the mode of cure by injection, which he has now very keenly adopted. In one part, indeed, of his treatise, he makes the following candid declaration: "I must confess, that I took an early and deep rooted dislike to the cure of hydrocele by incision."* Labouring under this kind of terror at other operations, and disappointed, as it would seem, in his expectation of the operation by the seton, he was thus ready to adopt the practice of curing the disease with injections, in the easy manner represented by the French, and which he has accordingly with great zeal done.

If longer experience, and farther improvement, shall evince the mode of curing the hydrocele by injections to be equally safe and certain with that by the simple incision, and shall obviate the objections that I have stated against it, none will be more ready to adopt it than I shall be. In the mean while, and in the present state of our knowledge, few practitioners will advise it, if it be not with those patients whose timidity precludes the more certain and equally safe method of cure, the operation by incision.

* Vide A Treatise on the Hydrocele, &c. by James Earle, Esq. p. 30.

SECTION IV.

Of the Hydrocele of a Hernial Sac.

WHEN the parts have been long protruded in hernia, a serous fluid collects in the bottom of the sac. In the scrotal hernia, if this extravasated serum is not soon removed by absorption, the tumor, we may easily imagine, may augment to such a size as to afford many of the usual marks of a hydrocele. Accordingly, besides different instances that I have now met of it in my own practice, a number of cases, I find, are enumerated by authors, which sufficiently warrant the insertion of this as a real, and perhaps not an unfrequent, variety of the disease.

It was well known to the ancients, that a considerable quantity of a fluid is frequently contained in the sac of a hernia, along with the parts protruded from the abdomen; but Saviard seems to have been the first who speaks of it with precision. Le Dran relates different cases of it: Heister speaks of it under the title of hydro-entrocele; and the late Dr. Monro describes it with his usual accuracy, and mentions a case of it where six pounds of water were evacuated from the tumor, by an opening made with a trocar.* A case of it is also related by Douglas,† and two cases of a similar nature are mentioned by Mr. Pott.‡

The serum is here confined in a cyst, formed by a process of the peritonæum; and, as it occupies nearly the same situation in the scrotum with the hydrocele of the tunica vaginalis, so we cannot always, by the feeling alone, mark the difference between them. For, although the testicle, in this variety of hydrocele,

* Monro's Works, p. 579.

† P. 182.

‡ Treatise on the Hydrocele, p. 21.

is commonly distinguished more evidently at the lower and posterior part of the swelling, than in the hydrocele of the vaginal coat, yet, the difference in this particular between the two diseases, is not always so evident as to afford sufficient means of distinction.

When a portion of gut, and other parts forming a hernia are down, the fulness they produce along the spermatic cord, serves, in some measure, to distinguish the disease from a simple hydrocele. And when, along with this and other symptoms of hernia, we evidently discover, in the tumor of the scrotum, a fluctuation of a fluid, if this fluid can, by pressure, be made to disappear, either entirely or in part, the nature of the case becomes thereby obvious.

This variety of hydrocele may take place as readily in the hernia congenita, as in any other rupture; and, in that event, the water must be contained in the same sac with the testicle and protruded intestines.

As all the fluid indeed naturally secreted for keeping the surface of the abdominal viscera moist, must, in a congenital hernia, fall into the sac, we would be induced to suppose, that almost every hernia of this kind should be complicated with a hydrocele of the sac. The two cases of this, related by Mr. Pott, appear to have been connected with hernia congenita; and I have met with it in different instances. But whether this commonly happens or not, further observation must discover.

With whatever hernia this kind of hydrocele is connected, if the water can, by pressure, be made to pass into the abdomen, this will always prove certainly characteristic of the disease; for, in no other species of encysted hydrocele, can the water be made to disappear by pressure. It may happen, however, in this kind of hydrocele, that this distinguishing symptom of the disease does not exist; for if, by the pressure of a truss, or any other cause, an adhesion is produced in the groin, between the sides of the hernial sac, if the under part of the sac continues open, with water col-

lected in it, the tumor produced by it will afford all the usual appearances of hydrocele, while no part of its contents can be made to pass into the abdomen by pressure. A case of this kind we find related by Le Dran, where the neck of the hernial sac was shut completely, and a hydrocele formed in the under part of it.

In this situation, the chief means of distinction are to be obtained from an acquaintance with the previous history of the case. When, in an ambiguous case, it is found, that, before the water began to collect in the scrotum, the patient had been liable to a hernia of the same side, this circumstance alone will tend much to determine the nature of the disease. But even although a mistake should occur, and although a hydrocele of a hernial sac should, in such circumstances, be mistaken for a simple hydrocele of the tunica vaginalis, nothing bad could ensue from it; for the treatment adapted to one variety of the disease, would apply with nearly equal propriety to the other; for here we conclude, that the parts which at first formed the hernia are reduced, and that the sides of the sac, in the upper part of it, adhere firmly together.

But, when the protruded parts still remain down, unless the operation for the bubonocoele is at the same time to be performed, no other should be attempted, but that of discharging the water with a small trocar, when the size of the tumor renders it proper. For, unless the operation for the hernia should be done at the same time, much harm might ensue from exposing the bowels so much to the air, as would necessarily be the case, by laying the tumor open for a radical cure of the hydrocele.

Whenever it is resolved, in this variety of hydrocele, to operate for a radical cure, the simple incision ought unquestionably to be advised; as, from the risk of injuring the bowels protruded from the abdomen, neither the seton, caustic, nor injections, are here ad-

missible. Indeed, this of itself affords a powerful argument in favour of the method of operating in every instance by the simple incision, which brings all the parts concerned in the disease into view. The very possibility of a patient being killed, by a seton passing through a portion of intestine contained in a hydrocele, is a weighty objection against the seton being ever employed; and every practitioner must acknowledge, that when the spermatic process along the groin is much distended, and the vaginal coat of the testis much thickened, that such uncertainty often occurs, as to render it impossible for the most skilful surgeons to determine with precision, what the contents of such swellings really are. In the instances to which I allude, of a hydrocele connected with a congenital hernia, and which I met with some years ago, there had not been previously any cause to suspect the real nature of the case. They were, by skilful practitioners, judged to be collections of water in the tunica vaginalis, without any complication whatever; and, on the tumor being laid open, together with water in contact with testicle, a piece of intestine was found protruded into the upper part of the scrotum. In one of the cases too, a small portion of omentum accompanied the gut.

In this last, it had been proposed, at a consultation of surgeons, to employ the seton. For some reason or other, this was fortunately rejected; for, on laying the tumor open by incision, it evidently appeared, that if a cord had been introduced, it must in all probability have passed through the protruded gut.

SECTION V.

Of the Anasarca Hydrocele of the Spermatic Cord.

IN the anatomical description given in the first section of this chapter, it was observed, that soon after the descent of the testis, the passage along the spermatic process of the peritonæum, is completely obliterated, by the sides of the passage adhering together.

By external pressure, and in some instances, perhaps from other causes, this adhesion of the sides of the peritoneal process, is in general very firm in that part of it which passes along the groin; but the superior and more internal part of the process, is not only more loose in itself, but is connected with, and enveloped in a very loose cellular substance.

From this cellular structure of these parts we might à priori, suppose them to be liable to the same kind of anasarca or œdematous swellings, with which other parts of the body, of a similar structure, are frequently attacked; and accordingly we find that this is the case. This anasarca swelling sometimes accompanies ascites; and it now and then appears locally, without being combined with either of these.

The causes of this variety of hydrocele in general, are, obstructions produced in the lymphatics, leading from the part, by scirrhus affections of the liver, spleen, and other abdominal viscera. I have likewise known it induced by the pressure of a truss applied for the cure of a hernia.*

When the swelling is connected with anasarca in other parts, it is thereby so distinctly marked, as to render a particular description of it unnecessary. When it takes place as a local disease, its appearances are these: a colourless tumor in the course of the sper-

* An instance of this is also mentioned by Douglas. Treatise on the Hydrocele.

matic cord; soft and inelastic to the feel, and not attended with fluctuation. In an erect posture, it is of an oblong figure, but when the body is in a recumbent posture, it becomes flat. It does not commonly occupy more than the usual stretch of the cord along the groin, but occasionally it extends down the length of the testicle, and even stretches the scrotum to an enormous size.*

By pressure, the swelling can be always made to recede, never entirely, but often in great part, into the cavity of the abdomen. It instantly, however, returns to occupy its former situation on the pressure being withdrawn.

When the tumor is connected with general anasarca, unless the cause which gave rise to the disease of the constitution is removed, it would be a vain attempt to endeavour to cure this particular symptom. And it commonly happens, that these swellings in the groin, arising from anasarca, disappear when the disease of the system is carried off.

But when the swelling occurs as an original disease, produced, perhaps, by some local cause; a local remedy is then the best means we can employ. In this case, as we have not the general bad habit of body to encounter, which commonly occurs in scrotal anasarca, we need not be so much afraid of making a free incision into the tumor; and accordingly, all that is necessary to be done is this; as soon as the tumor has acquired such a size as to become inconvenient, an incision should be made with a scalpel from one end of it to the other, taking care to go so deep, as effectually to discharge all the fluid contained in the cells of the part; and as the serum is sometimes found to have acquired a viscid consistence, this circumstance renders a deep incision more necessary than it otherwise would be. In making this incision, we have

* A remarkable instance of this is related by Mr. Pott, who, from a swelling of this kind, discharged eleven English pints at once. *Treatise on Hydrocele, case x.*

chiefly to avoid what may be properly termed the constituent parts of the spermatic cord, the spermatic artery and vein and vas deferens, and which, in every instance, may always with certainty be done.

The contents of the swelling being removed, a pledget of soft old linen, spread with common wax ointment, should be inserted between the lips of the fore, which must afterwards be treated as a simple wound from any other cause; by poultices and fomentations, if much pain and a scanty suppuration take place; and by due attention to dressing, so as to induce the formation of firm granulations from the bottom.

In some instances, a cure has been attempted by making deep punctures in different parts of the tumor; but while they do not with such certainty remove the disease, they are equally painful with an incision carried the full length of the tumor.

SECTION VI.

Of the Encysted Hydrocele of the Spermatic Cord.

THE surrounding substance of the spermatic cord being entirely cellular, the formation of encysted tumors, we may conclude, ought occasionally to take place here, as well as in other parts of the body; and accordingly we find, in some instances, that water, instead of diffusing itself over the whole spermatic process, is collected in one or more distinct cells or cysts.

This kind of hydrocele being on its first appearance small, gives little or no trouble, and is therefore seldom much noticed, till it has acquired a larger size. In some, it begins in the superior part of the process; but, in general, it is first perceived towards the lower part of it, a little above the epididymis. By

degrees, however, it stretches upwards, and, in some instances, so far down as to reach from the abdominal muscles to the very bottom of the scrotum; in which case, a person who had not formerly seen the disease, might be apt to mistake it for a hydrocele of the tunica vaginalis. But we have a very certain mark of distinction between the two diseases.

In the commencement of this variety of hydrocele, the tumor is always above the testicle, which is distinctly felt below; and in the more advanced stages of the disease, the testis is found at the back part of it. Whereas, in the advanced state of a hydrocele of the tunica vaginalis, although some degree of hardness takes place where the tunica vaginalis adheres to the testicle, yet when the tumor is large, the testis can never be distinctly felt. In the encysted hydrocele of the cord, the figure and size of the penis is not commonly so much altered, as when the water is collected in the tunica vaginalis, in which the penis frequently disappears almost entirely.

In other circumstances, the encysted dropsy of the spermatic cord, is very similar to the hydrocele of the tunica vaginalis testis. A fluctuation of a fluid is sensibly discovered on pressure. The tumor is commonly of a pyramidal form, which is also the case with the other, with its base or largest extremity downward.* And no pressure has any influence in making it disappear, either altogether or in part.

This is the appearance of the tumor when the water is contained in one cyst. When separated into two distinct cells, as sometimes happens, the line of division is commonly evident by the tumor being at that part somewhat puckered, or diminished in its diameter. A similar appearance also takes place, when

* A hydrocele of the tunica vaginalis testis, is so frequently indeed of a pyramidal form, with its base downwards, that this shape may be considered as one of the characteristic appearances of the disease; every other tumor to which the testis and its coats are liable, being either more round, or of a more irregular shape.

this variety of hydrocele is combined with a real hydrocele of the tunica vaginalis testis, which, in some instances, happens; and in this case, a line of separation may be observed, where the upper extremity of the tunica vaginalis terminates.

The means of distinction between this species of hydrocele, and that of the vaginal coat of the testis, have already been mentioned. The only other tumors with which it is in danger of being confounded, are, the anasarcaous hydrocele of the spermatic cord, and a real hernia, either of the omentum, or of a portion of gut. From the former, however, as also from an omental hernia, it may in general be distinguished. In neither of these, is the fluctuation of a fluid to be perceived, and to the touch they are both soft and inelastic; whereas, in this variety of hydrocele, the tumor has a springy kind of feeling, and a fluctuation is sensibly found in it. And in both the others, the swelling in some degree recedes upon pressure, which it never does in this variety of encysted hydrocele.

From a hernia of any portion of gut, it is chiefly distinguished by the tumor beginning, not at the ring of the external oblique muscle, as is the case in hernia, but farther down the cord. In the latter, the swelling commonly becomes less on the patient being placed in a horizontal posture; and it is always considerably affected both by coughing and sneezing; but no posture, no pressure, nor any accidental circumstance, alters the size of this variety of hydrocele. The absence of the symptoms of hernia, too, is here material in the distinction. For there is neither pain in the tumor, nor in the abdomen; nor sickness, vomiting, nor any interruption to the passage by stool, as very commonly happens in hernia.

Although all the ancient writers were ignorant of the anatomy of the parts concerned in this disease, it is evident they were well aware of its existence. We find it particularly described by *Ægineta*, *Albucasis*, and afterwards by *Fallopious*, *Wiseman*, and others.

Arnaud, in his Treatise on Herniæ, also takes notice of it, though not with much accuracy; and we find it more lately described with exactness by the late Dr. Monro, by Douglas, and by Mr. Pott.

This variety of hydrocele, as also the anasarcaous swelling of the cord, and the œdematous tumor of the scrotum, are all frequent in infancy. These tumors, however, in childhood, seldom prove permanent. For the most part, they readily yield to gentle friction with volatile liniment, or any other stimulating or astringent application; such as spirit of wine, a strong solution of alum in water, or of crude sal ammoniac in vinegar. The late Dr. Monro advises the application of cloths warmed with the fumes of burning benzoin.

Even the hydrocele of the tunica vaginalis sometimes occurs in early life. I have met with different instances of it in children under three years of age; but it is not so readily acted upon by the external application of stimulants, as the anasarcaous hydrocele.

Whether in children or adults, when this variety of tumor becomes large, we employ either the means for a palliative, or a radical cure, as have been already advised in the hydrocele of the tunica vaginalis testis.

When it is our intention merely to discharge the water by a puncture, it should be done with a trocar, in the same manner as was directed in Section III. for a hydrocele of the tunica vaginalis; taking care to introduce the instrument at the most depending part of the tumor. And again, when we mean to accomplish a radical cure, the same means are to be employed, that have been already advised for the radical cure of that variety of the disease in the tunica vaginalis testis. The same objections indeed do not here occur to the use of the seton, as in the hydrocele of the tunica vaginalis, from the presence of the testis. And if we could, in every species of hydrocele, ascertain the exact contents of the tumor, the seton might, no doubt, be here employed with safety and advantage. But, as it is obvious, from what I have already had occasion

to remark, that no certainty of this can at all times be obtained ; and, as the hydrocele of a hernial sac, in which a portion of gut is contained, may be as readily confounded with this as with any other species of the disease, I would therefore, even in the hydrocele of the cord, lay this method of cure entirely aside.

An objection occurs, in this variety of the disease, to the method of cure by caustic, which is not applicable in the hydrocele of the tunica vaginalis testis. The serum, in some instances, is collected in two or more cysts ; different cases of which I have met with ; and similar instances of it are related by Garengéot, Douglas, and others. Now, in this situation, if caustic should be applied in the method recommended by Mr. Else, upon a small spot only, all the water would not be discharged ; and, in order to obtain a complete removal of the disease, it would be necessary to repeat the application of the caustic to every cyst in which serum might be collected.

This, I think, is an additional reason for our giving a general preference to the method of cure by incision ; which, by laying the tumor open from one end to the other, divides at once all the different cysts of which it may be composed, and saves the patient from that distress and disappointment which must always be experienced, on a complete cure not being obtained, when good reasons had been previously given for expecting it. I would therefore advise the treatment by incision to be preferred in this species of hydrocele, as I have done already in the hydrocele of the tunica vaginalis ; and the mode of performing the operation, and the after treatment of the patient, are nearly the same in each.

I have thus enumerated every hydrocele that can be properly considered as forming a distinct variety of the disease. In doing so, as I have described no tumor but such as every practitioner of experience must have met with, and of which the symptoms are clear-

ly and distinctly marked, so it will not, I hope, be considered as an unnecessary degree of minuteness, that I have particularly taken notice of them all.

I can by no means agree with some authors, particularly with Mr. Sharpe* and Mr. Else, who think that it might be better to confine the description of hydrocele to two varieties. We need not indeed wonder at Mr. Sharpe speaking in this manner ; for, even at the late period in which he wrote, although the existence of all the varieties of the disease that I have mentioned had been described by different authors, yet they were not understood with much accuracy ; and it is evident from Mr. Sharpe's writings on the subject, that his ideas of them were in many respects more confused than might have been expected in one of his usual accuracy and penetration. But, whatever was the case with Mr. Sharpe, it is truly surprising, that those who are unquestionably well informed in every circumstance relating to this disease, and who must be convinced, from frequent dissections, of the existence of all the varieties that I have been mentioning, should object to their being retained. Where no evident or marked distinction occurs between one tumor and another, an attempt to establish a difference would be useless, and therefore improper ; but where appearances point out an obvious variety, it would surely be considered as much want of accuracy in an author to omit the detail of them.

In the description that I have given of the five different species of hydrocele, to wit, the anasarctous swelling of the scrotum, the hydrocele of the tunica vaginalis testis, the hydrocele of the hernial sac, the anasarctous and the encysted hydrocele of the spermatic cord, it was necessary to enumerate the symptoms of each, as they occur separately and uncombined. It sometimes happens, however, that one, two, or more of the different varieties occur at the same time in the

* Treatise on the Operations of Surgery.

same patient. I have met with instances of three, and not unfrequently with two varieties in the same person. The late Dr. Monro mentions an instance of four species of hydrocele being all combined in one case.*

In such cases, some difficulty and confusion is, no doubt, to be expected; but practitioners, in forming a judgment of their nature, must be entirely directed by due attention to the various symptoms which take place in each variety of the disease, when met with separately, and unconnected with others.

We now proceed to the consideration of the other varieties of false hernia; and first of the hæmatocele.

* Vide Monro's Works, 4to. p. 576.

CHAPTER XXV.

ON THE HÆMATOCELE.

THE hæmatocele is a tumor in the scrotum or spermatic cord, produced by extravasated blood.

The usual seat of this disease is in the tunica vaginalis of the testis ; but, in some instances, it is seated in the spermatic process, and occasionally it is met with in the dartos.

The hæmatocele always arises from the rupture or division of one or more blood vessels, and it is most frequently the effect of external violence. Blows upon the scrotum, and bruises received in riding, sometimes burst the veins, not only in the cellular substance of the scrotum, but in the vaginal coat of the testicle. Accidents of a similar nature have produced similar affections in the course of the spermatic cord ; and, as the parts in this situation are soft and cellular, the rupture either of an artery, or a vein of any considerable size, is, for the most part, attended with a plentiful extravasation of their contents.

In the tunica vaginalis testis, a hæmatocele is sometimes induced by the point of a trocar, or of a lancet, in tapping for a hydrocele, wounding some of the blood vessels of the sac, which, in such cases, are commonly enlarged.

We become certain of what has happened, by the serum, as it runs off, being suddenly tinged with blood ; but, in some instances, this does not appear till the collection is all discharged, when the first intimation we receive of it is by the sudden appearance of a tumor in the site of the hydrocele. I have now met with various instances of this, in all of which the tumor produced by the extravasated blood arrived at a very considerable height in the course of a few hours.

In some, the disease is produced in a different manner. Where the quantity of serum has been large, the sudden discharge of it, by taking away the support which the vessels have been accustomed to receive from it, is not unfrequently the cause of the rupture of some of them; and, from repeated observation, I think it may be considered as certain, that whenever a large tumor is produced suddenly, that is, in the course of an hour or two, either in the scrotum, or spermatic cord, after the contents of a hydrocele have been discharged by tapping, that it arises entirely from extravasated blood; for collections of water are never known so quickly to become large.

In the spermatic process, injuries of the same kind will be attended with a similar effect upon the small veins of the sac containing the water; and more considerable violence has, in some instances produced a rupture of the spermatic artery and vein.

But in whatever way the tumor has been produced, the appearances are nearly similar to those of watery collections in the same parts; so that it is not necessary to repeat them here; only it may be remarked, that, when blood is extravasated in the cellular substance of the scrotum, it is easily distinguished from a collection of water by the colour, as it assumes all the usual appearances of an echymosis. When the collection is seated in the tunica vaginalis, the means of distinction are not so obvious; but I may remark, that a tumor produced by blood is heavier than one of the same size produced by water; and practitioners, much accustomed to handle these swellings, can in some instances judge of their contents from their consistence, by the difference which this gives to manual examination.

The treatment of this kind of tumor is nearly the same with that which I have advised in Sect. IV. Chap. XXIV. In the commencement of the anasarcaous or diffused hæmatocele, when produced by external violence, whether in the scrotum or spermatic process,

the application of ardent spirits, a solution of alum, volatile liniment, or a strong solution of sal ammoniac in vinegar, will, in some instances, remove it. But, when this does not succeed, and especially if the tumor acquires a greater bulk, it must, in that case, be laid open, and, in every respect, treated in the same manner as has been already directed for the hydrocele; only I may remark, that, if a ruptured blood vessel is discovered, the only effectual means of preventing a return of the tumor, is to secure it with a ligature.

In like manner, all collections of blood, whether in the vaginal coat of the testis, or in the cyst of a former hydrocele of the spermatic cord, are to be laid open by an incision, extending the whole length of the tumor, and, in other respects, treated exactly as I have advised in the fourth section of the preceding chapter, for a hydrocele. And I need scarcely observe, that, if any ruptured vessel comes in view in the course of the operation, it ought to be immediately secured with a ligature: otherwise a constant discharge of blood may be looked for during the cure; the patient will be thereby much incommoded and weakened, and the cure unnecessarily protracted.

It sometimes happens, however, whether the disease is seated in the spermatic process, or tunica vaginalis testis, that the vessels from whence the blood is discharged cannot be discovered; a very considerable oozing, continuing from day to day, notwithstanding the use of bark, vitriolic acid, and every other means that are commonly employed. As patients in this situation soon become weak and emaciated, one great object of the practitioner is to support them with nourishing food. A moderate allowance of animal food proves always useful; nor is it found that a liberal use of wine does harm. In some instances, I have even thought that it tended to lessen the discharge.

I have uniformly, however, found, that local remedies prove chiefly useful, particularly the application of ardent spirits, ether, or tincture of myrrh, to the

surface of the sore: pledgets of soft lint, soaked in one or other of these, and renewed from time to time, not only serve to check the discharge of blood, but tend, for the most part, to promote the formation of good matter.

In some instances, however, all our endeavours fail, and the patient continuing to lose ground daily, we are warranted in advising any measure that may probably tend to save him. In such circumstances, the extirpation of the testicle has been advised. At one time, I was induced to think favourably of this measure; but further experience has not shown, that much dependence is to be placed on it. At least, in two cases, in which it was put in practice, no advantage was derived from it; while, in both, it was the cause of much additional distress. I do not therefore mean ever to advise it again.

Another variety of tumor produced by blood is mentioned by Mr. Pott, in which the blood is contained within the tunica albuginea of the testis. It proceeds, he thinks, from a relaxation or dissolution of part of the vascular structure of the testicle; and, when the quantity of blood collected is considerable, it produces, Mr. Pott remarks, a fluctuation somewhat like to that of a hydrocele of the tunica vaginalis.

When this is mistaken for a hydrocele, as it has sometimes been, and an opening with a trocar is made in it, a discharge is produced, of a dark dusky coloured blood, nearly of the consistence of thin chocolate; but the diminution of the tumor, by this evacuation, is seldom considerable.

The perforation, therefore, made in it with the trocar does no good; and as the testicle is commonly so far spoiled by the disease as to be rendered entirely useless, castration is advised as the best remedy.*

* Pott's Treatise on the Hydrocele.

I have different times met with a disease very similar to this described by Mr. Pott: but as the blood in such instances did not appear to be extravasated, but to be still contained in the vessels of the testis, in an enlarged varicose state, I am not inclined, therefore, to refer this kind of tumor to any species of hæmatocele, but rather to consider it as a variety of varix. I have even seen this variety of tumor mistaken for a hydrocele, and treated as such, by a trocar being plunged into it, when the effects were exactly what are described by Mr. Pott. But, if the blood had been extravasated, a more copious discharge would have taken place from the perforation, than was obtained by it in any of the cases to which I allude. Even where the tumor has been of a considerable size, I never found it possible to evacuate in this manner more than a spoonful or two of blood, and although, in such cases, the blood appears evidently more viscid than in a state of health, this is not in such a degree as ought to prevent it from being freely discharged by the canula of a trocar, were it lodged in a state of extravasation.

In all the cases that I have seen of this tumor, when it was not opened, but merely supported by a suspensory bag, it has remained indolent and stationary for many years. But whenever it has been touched with an instrument in order to discharge its contents, it has from that moment gone wrong. The patient who had suffered little previous pain, soon became greatly distressed; the swelling then began to increase; separate encysted collections formed in it; these at last burst and left an ugly sore of an unequal surface, and a putrescent bloody discharge, on which no application had any effect; so that castration at last became necessary. Even this does not always afford relief; for, in some instances, such a spongy relaxed state of the vessels takes place along the whole course of the cord, that, though they are secured with ligatures to-day, blood bursts out at different parts to-morrow. Of this I

was once concerned in a very distressful instance. After the usual operation of castration, fresh hæmorrhages occurred at every dressing; the vessels were at different times secured with ligatures, but to no purpose; the blood burst out again and again; and the patient, after suffering much distress from this cause alone, at last died.

The chief differences which, before laying the parts open, can be observed between this variety of tumor and a hydrocele of the tunica vaginalis, is, that in this, the fluctuation is never so evident as in the other; the tumor is heavy in proportion to its size; the form not so pyramidal as that of a hydrocele; and if properly supported with a bandage, it does not receive any additional increase. Whenever these circumstances, therefore, occur in the same case, they give much reason to suspect, that the disease is of this kind; and therefore, that no operation should be advised. The patient should be desired to trust entirely to a well adapted suspensory bag; to avoid severe fatigue; and to prevent a costive state of the bowels, which in all diseases of these parts, very constantly does harm.

CHAPTER XXVI.

OF THE VARICOCELE, CIRCOCELE, SPERMATOCELE,
AND PNEUMATOCELE.

BY the term varicocele, is meant a varicose distention of the veins of the scrotum, which in this state form a tumor of hard knotty inequalities, seldom attended with pain, and commonly productive of no inconvenience, if it be not from its bulk.

The circocele is a tumor of the spermatic cord, extending from the superior part of the scrotum to the abdominal muscles, and is produced by a varicose distention of the spermatic vein.

These tumors are occasionally produced by pressure on the course of the veins; but we are seldom able to distinguish the cause of it, in which case, we conclude, that they arise from debility or relaxation in the vessels in which they occur.

When tumors in the course of the veins are perceived to give rise to these tumors, or when the pressure of a hernial truss upon the spermatic cord appears to have produced them, the removal of this evident cause of the disease, should be the first attempt towards a cure.

When produced by the pressure of a truss, or of any other similar cause, an alteration in the bandage will sometimes remove them. When the pressure of schirrous tumors give rise to them, these must be extirpated when it can be done with safety; and when produced by tumors tending to suppurate, warm emollient applications will be the most useful remedy.

But when a general relaxed state of the veins appears to be the cause of their distention, such remedies should be employed as will most effectually re-

cover that tone of which they have been deprived by the long continuance of the disease. With this view, nothing commonly answers so well as the use of a proper suspensory bandage, and the application of a solution of alum, a solution of crude sal ammoniac in vinegar, and other astringents, to the parts affected.

By due attention to this kind of management, the increase of almost every tumor depending upon this cause, may be prevented; and so much relief will be thereby obtained, as to render the harsh remedies of the knife, the cautery, and ligature, recommended by ancient writers for the removal of these tumors, altogether unnecessary.

By the spermatocele, is meant, a morbid distention of the epididymis and vas deferens, produced, as is supposed, by a stagnation of semen. This may arise from tumors, stricture, or inflammation about the caput gallinaginis, or in the course of the vas deferens; but there is reason to think, that it is most frequently induced by inflammation.

When produced by inflammation, general and topical bloodletting, gentle laxatives, a low cooling diet, and rest of body, will commonly prove the most useful remedies, and of these none are more to be trusted than topical bloodletting with leeches which should be repeated from time to time, according to the urgency of symptoms. And again, when tumors are discovered to press upon the vas deferens, they should either be brought to suppurate, or removed with the scalpel, when it can be done with safety. At other times these tumors are connected with lues venerea; in which case, a well directed course of mercury will be most likely to answer.

By some we are told, that all the other means having failed, castration has at last been found requisite.

This, however, I can scarcely suppose to be necessary in any case; at least I never met with an instance of its being so.

The term pneumatocele, is applied to signify a distention of the scrotum by a collection of air.

This has been described by most of the ancient writers as a frequent occurrence; but there is much reason to think, that a great proportion of all the tumors which they describe as containing air, were either formed by collections of water, or by the protrusion of some of the bowels. That species of hernia to which young children are liable, is to this day, by our common people, termed a wind rupture, as is the case with all those collections of water in the scrotum, with which new born infants are affected. But we know well, that none of these tumors are formed by air; and that their contents are of a very different nature.

In wounds of the lungs, air is sometimes thrown into the surrounding cellular substance, and in that way passes into the scrotum, as it does in particular instances over the whole body; and in high degrees of putrid diseases, so much air may be separated from the blood, as to distend the cellular substance of the scrotum, as well as of other parts. But a real pneumatocele has never probably existed as a mere local affection of the scrotum; at least I have never seen it.

In the case of air spreading to the cellular substance of these parts, as a consequence of a wound of the lungs, the same remedy proves effectual that we employ for anasarcaous swellings formed by water, to wit, small punctures with the point of a lancet, which are found to be sufficient for discharging great quantities of air. But whenever the disease is induced by such a degree of putrescency in the system, as excites a separation of air from the blood, there can be little reason to look for advantage from any means that can be employed.

CHAPTER XXVII.

OF THE SARCOCELE, OR SCHIRROUS TESTICLE.

THE term sarcocoele, implies a firm fleshy enlargement of the testicle: a simple inflammatory swelling of the testis affords a tumor of some degree of firmness; but the true sarcocoele, or schirrous testicle, is attended with a hardness altogether unusual in the real hernia humoralis, or inflamed testicle.

A schirrous testicle, in the course of its progress, puts on such a variety of appearances, as renders it difficult, by description, to give an adequate idea of it. In general, however, the accession and progress of the disease is this:

An unusual degree of hardness, attended with some enlargement of the testis, is the first indication of the disease. The parts are not at first discoloured, nor is there any material degree of pain. In a gradual manner, the tumor acquires a larger size. At first, it is smooth and equal, but on becoming larger, it also becomes harder and knotty or unequal on the surface; slight pains are felt in every part of it; and if it be not suspended, the patient complains of uneasiness in his back.

When the constitution is sound, the disease will occasionally remain in this situation for a great length of time; and in some instances, by moderate diet, keeping an open belly, suspending the tumor properly, and avoiding violent exercise, it has not only been prevented from increasing, but, in a gradual manner, has been dissolved. This favourable termination, however, it must be owned, is exceedingly rare; for instead of remaining stationary, the disease in general becomes worse. It acquires a larger size; becomes

ragged, and more unequal on its surface; and the pain, which at first was trifling, becomes more severe, darting, in smart stings, through every part of the tumor.

The inequalities on the surface of the tumor by degrees increase. In some instances, a considerable quantity of serum is extravasated into the tunica vaginalis, which, to those who are not versant in the treatment of diseases of this kind, gives the tumor the appearance of a common hydrocele; and at other times, instead of such depositions into the vaginal coat of the testicle, partial collections of matter take place through the whole body of the tumor. These by degrees increase, and the scrotum, which till then had been gradually distending, at last bursts, and a discharge takes place from the various collections in the body of the tumor, of a thin, fetid, bloody matter.

In some instances, the spermatic cord becomes hard and enlarged soon after the commencement of the disease; but this does not commonly happen till the tumor has acquired a considerable size, and most frequently, I have observed, not till matter has formed in it.

On the testis increasing in bulk, this affection of the cord also becomes worse. From being at first only slightly tumefied, it gradually turns more hard and swelled; it becomes so painful, that the patient cannot bear to be touched, and knotty or unequal through the whole extent of it.

The discharge from the openings in the scrotum still continues; but although the quantity of matter is increased, the size of the tumor is not thereby diminished. It rather continues indeed to increase, the edges of the sore become hard, livid, and retorted, and fungous excrescences push out from different parts of it.

Whatever was the state of the patient's health on the first attack of the disease, in this advanced state of it, it is always much impaired. He now becomes

emaciated, of a pale, wan complexion, and the disease, which in this stage, is a real cancer of the most malignant nature, turning still more virulent, by the pain becoming more tormenting, the patient is at last carried off in much misery.

Such, in general, is the progress and event of this dreadful disease, if not interrupted by the extirpation of the testis, before it has gone too far. I have already observed, that it exhibits a great variety of symptoms. Those I have enumerated occur most frequently; but no description can convey a clear idea of all the appearances that it assumes.

In some, as I have observed above, it remains apparently in an indolent inactive state, for a great length of time, even for years; and in others, it proceeds so rapidly, that in the space of a few months, I have known it pass through all the changes I have enumerated.

Nor is any age, temperament, or line of life, exempted from it: it happens equally to the opulent and to the most indigent; and I have met with it in all ages, from the sixteenth to the seventieth and eightieth year, but not so frequently in early youth, as in more advanced stages of life. In a great proportion of cases, the disease begins in the body of the testis, affecting the whole of it equally; but in some, it makes its first appearance in the epididymis, and occasionally even in the spermatic cord. It has been a prevailing opinion, indeed, that a scirrhous hardness, tending to cancer, never begins in the epididymis, and that the testicle is always first affected.

This is certainly in general the case, but every practitioner must at times have met with instances of cancer beginning in the epididymis, and sometimes even in the spermatic cord, and spreading from thence to the neighbouring parts. I might here insert different cases which have fallen within my own observation; but Mr. Pott's collection furnishes a sufficient number of well marked examples.*

* Treatise on the Hydrocele, cases 42, 48, and 49.

In almost every case of swelled testicle from gonorrhœa, the epididymis is not only affected before the testicle, by the inflammation spreading from the urethra, along the vas deferens; but the swelling, when it begins to yield, always first removes from the testicle, leaving in general, a hardened state of the epididymis, which for the most part, continues in some degree during life. But as the hardness produced in this manner is entirely the effect of inflammation upon a membranous or vascular part, so here, as in other parts of the body, of a similar texture, we seldom find that hardness induced by inflammation terminates in cancer.

The contrary however, of this has been inculcated; and it has even been said, that the hernia humoralis produced by gonorrhœa, and that tumor of the testis which we sometimes meet with from lues venerea, are frequent causes of sarcocoele; which in various instances has done harm, by tending to prevent a trial of mercury, the only remedy which in tumors of the testis arising from this cause, has ever as yet proved of any real utility.

But, although tumors of the testis, from a venereal cause, seldom terminate in this manner, yet I will not go so far as to say that they never have done so; for I know, that a hardened state of the testis and epididymis produced originally from a venereal taint, does in some instances, degenerate into the worst species of sarcocoele. That is, that although tumors in this part, arising from lues venerea, are most frequently cured by mercury, yet occasionally and in particular constitutions, the peculiarities of which, however, we are not acquainted with, they do certainly end in schirrus of the worst kind, a disease which might never probably have appeared, if the original venereal taint had not acted as an exciting cause of it. We know that a predisposition to diseases will remain long in a latent state in the system, without any evident symptom being excited, till the application of some particular

stimulus brings it into action. In the same manner, a venereal affection of the testis, or even that hardness of the epididymis that remains after an inflammatory tumor of these parts from gonorrhœa, will in some constitutions, terminate in sarcocoele, although in a great proportion of cases it is otherwise, and no distressful consequence results from them.

I have dwelt the longer upon this, from a contrary doctrine having been strenuously inculcated by one whose authority is deservedly great, and whose observation in this disease has led to the conclusion he endeavours to establish.* But, as the result of my experience has been exactly what I have stated, I could not avoid speaking of it in the manner I have done.

In the treatise to which I allude, we are told, that hernia humoralis is never productive of sarcocoele. If, on this subject, Mr. Pott's idea is just, it ought undoubtedly to be received; but, if it is not, it may certainly do harm, by rendering both patients and practitioners more remiss in cases of sarcocoele proceeding from this cause, than they otherwise would be; as, by continuing still to expect that a mercurial course may accomplish a cure, they may allow the disease to go too far before extirpation is advised.

In every doubtful case, when lues venerea is suspected to be the cause of the tumor, bloodletting, when the pulse is full, an open belly, a cooling diet, a horizontal posture, a proper suspensory bandage, and a well directed course of mercury, will commonly remove it. But, when these means are employed without advantage; and especially if, during their application, the tumor, instead of decreasing, becomes gradually worse, as soon as, from its increase, there appears to be any risk of its advancing too far to admit of being extirpated, it ought, without further hesitation, to be removed, whatever the cause may be by which it was at first produced.

* Mr. Pott, Treatise on the Hydrocele, &c. p. 232.

Among other causes which authors have mentioned of *sarcocoele*, is the *hydrocele* of the *tunica vaginalis*. From quantities of a serous fluid being frequently found in the vaginal coat of a *schirrous* testicle, it has been supposed, that the water, in such cases, was the original cause, and not the effect of the disease in the testis. There is much reason, however, to think, that in these collections of water in the *tunica vaginalis*, in which the testis is found diseased, that the hardened state of that organ ought to be considered as the original disease, and not the water which surrounds it.

Collections of water are, no doubt, often met with, even in a real *sarcocoele*; but this we are to consider entirely as a different stage of the same disease: for, although the true *sarcocoele* is not at first attended with any collection, either of blood or serum, it is natural to suppose, that an enlarged or hardened state of the testis must have some influence, both on the quantity and appearance of the fluid with which the *tunica vaginalis* is always provided.

If it either excites an augmented secretion, or a diminished absorption of this fluid, a dropical swelling must take place; and every such collection combined with a *schirrous* testicle, has been very properly termed a *hydro-sarcocoele*.

That the testis, by remaining long immersed in the serum even of a true *hydrocele*, is frequently altered in its texture, there is no reason to doubt. Thus, on laying open the *tunica vaginalis* in a common *hydrocele*, the testis is very commonly of a more pale appearance than in a state of health.

In some cases, it is much diminished, and, in others, considerably enlarged; but all such enlargements, when connected with a real *hydrocele*, are of a soft, harmless nature, and never give pain. In this state, the testis should never be extirpated.

This is a point, I may remark, which it is of much importance to ascertain: for, on the idea of this enlargement of the testis, frequently connected with, and

perhaps produced by immersion in the water of a hydrocele, being truly schirrous, the operation of castration has been often advised, and unfortunately practised. In circumstances of doubt, the means of distinction between the mild and malignant variety of enlarged testicle, by which we should in general be directed, are these : when either the body of the testis or epididymis, or both, are hard and enlarged previous to any collection of serum in the tunica vaginalis, such collections as afterwards take place ought not to be considered as constituting a simple hydrocele. If the tumor has been accompanied with pain, and if, upon discharging the serum by incision, the testis, besides being enlarged, is hard or ulcerated on its surface, extirpation should be immediately advised ; but, on the contrary, when the water of a hydrocele is known to have been collected while the testicle remained sound, and of its natural size, whatever enlargement it may be found to have acquired on laying the sac open, if the testis is neither of a schirrous hardness, nor affected with pain or ulceration, we ought unquestionably to proceed as in a case of simple hydrocele ; for, this kind of enlargement will be rarely found to excite future uneasiness, and will consequently seldom or never render extirpation necessary.

In judging of the probable termination of a schirrous testicle, different circumstances require attention : the age and habit of body of the patient, the duration of the disease, and the state it is in at the time.

Thus, whatever treatment is to be adopted, more success may be reasonably expected in a young healthy person, than in the reverse ; particularly if extirpation of the testis is to be advised. In patients that are otherwise in good health, the chance of success from the operation is commonly considerable, provided the disease is not too far advanced ; whereas, in old or infirm people, and in habits attended with pale, wan complexions, with indigestion, and other symp-

toms of obstructed viscera, whatever state the disease may be in, little or no advantage is likely to accrue from any operation.

The complexion, of itself, I must observe, does not, in this disease, merit much attention; for, I have scarcely met with an instance of the true sarcocoele, even in the early and most simple stage of the disease, in which a pale complexion did not take place. It seems to be, in a great measure, the effect of that anxiety and dread for the final event of the disease, to which patients, with tumors of this description, are particularly liable; but it is materially different from that wan, sickly countenance, often accompanied with a slight tinge of bile, that we meet with in the advanced state of the disease, when attended with obstructions of any of the abdominal viscera.

With respect to the duration of the disease, if it has already subsisted for a considerable time without making progress, there will be reason to think that it is of a mild nature, and that the system is not so much affected as if its progress had been great and rapid; and, lastly, the state of the tumor at the time is of much importance in forming a prognosis of the event. As long as the testicle is only somewhat hard and enlarged, without the formation of matter, and without any disease of the cord, if the constitution is otherwise healthy, there will be much cause to hope for a favourable event from any operation that is advised.

But, on the contrary, when the disease is so far advanced, that collections of matter have formed, either upon the surface of the testicle, or in its more internal parts, as in this state there will be cause to suspect that the constitution has suffered from absorption, so there will be less cause to hope that the operation will prove successful, than in the more early stages of the disease. And this is more remarkably the case, when ulcerations have taken place on the surface of the tumor; for we know well that absorption is much more apt to occur from tumors in a state of ulcera-

tion, than from matter to which the air does not get access.

In whatever state, however, the tumor may be, there is always reason to hope for more success from the operation while the spermatic cord is yet sound, than when it has become diseased; for, as soon as the cord is much affected, the chance of success from any means that can be attempted, will be proportionally less. The cord, indeed, may, towards its under extremity, be diseased, even in the same manner with the testis itself, without lessening the chance of benefit from the operation; but, whenever the disease has spread so far up the cord as to render it doubtful whether the parts affected can be all removed by the knife or not; and especially, if there is reason to think that the cord is diseased within the boundaries of the abdomen, instead of there being, in such circumstances, any advantage to be expected from the operation every attempt towards the removal of the parts below, will, for certain, tend to aggravate the symptoms, and hasten the death of the patient.

When a schirrous or cancerous tumor is so situated, that it can be entirely removed, the operation ought immediately to be advised; but when the disease has advanced so far as to render this impossible, in whatever part of the body it may be seated, no attempt of this kind should be made, the fact being now clearly ascertained, that cancerous affections are always rendered worse by extirpation, when all the diseased parts cannot be removed.

It is of much importance, however, to observe, that the spermatic cord frequently becomes full and thick, merely by the weight of the tumor, without being in any other respect diseased. A fulness of this kind, when the cord itself is not painful, and when no knots or inequalities have formed upon its surface, ought not to prevent the operation, when in other respects, it appears to be necessary; for, a mere enlargement of the cord very frequently occurs, either from a vari-

cofe state of the veffels, or from a watery depofition in the cellular fubftance of the part, when it is not in any other manner difeafed.* But, when the cord, at the fame time that it has become enlarged, hard, and knotty, adheres to the neighbouring parts, is painful to the touch, or ulcerated, thefe, if the difeafe extends over the whole procefs, up to the abdominal mufcles, are circumftances which, with every prudent practitioner, will at all times forbid the operation of castration.

It has indeed, been propofed, in this ftate of the cord, to enlarge the opening in the external oblique mufcle, fo as by diffection, to trace the difeafed parts even into the cavity of the abdomen, with a view to remove them entirely. But, although theoretical writers may attempt to amufe their readers with fuch propofals, they will never be ferioufly thought of by practitioners whofe opportunities for obfervation enable them to think and act for themfelves.

It is unneceffary here to enumerate either internal medicines or external applications, as none have been employed with advantage for the removal of this difeafe. Cicuta and belladonna, fo much celebrated in cancer, have no effect in arresting its progrefs, or in mitigating its fymptoms. It is on the extirpation of the difeafed parts that we alone rely for a cure: hence, it is a point of the firft importance, to afcertain the period of the difeafe at which the operation fhould be propofed.

I have already obferved, that occasionally we meet with a fchirrous enlargement of the teftis, with which patients walk about for a great length of time, with little or no inconvenience. Such inftances, however, are rare; for by much the greateft proportion prove to be of a malignant nature, and proceed rapidly to a ftate of pain and hazard. I may therefore obferve,

* Of the point here inculcated, fome fingular proofs are recorded by Mr Pott, in his ufeul collection of cafes. See *Treatife on the Hydrocele*, Cafes xxxix. xl. xlix. and l.

that, whenever a schirrous or hardened state of the testicle does not yield to the means usually advised for it, such as moderate evacuations of blood, when these are indicated, a cooling diet, a lax belly, the use of a suspensory bandage, and especially when mercury, which, on the chance of the disease being venereal, is very commonly tried, are all used without advantage, we may, in such circumstances, always have much cause to suspect that the disease is of the worst kind. When more inveterate symptoms appear, when the tumor, which, till now, was in a hard indolent state, becomes painful, and increases in bulk, no further delay should be advised. For, however improper it would be to remove a hardened testis, which, for a considerable time, had remained indolent, without pain or increase, it would be equally unpardonable in any practitioner to advise the operation to be delayed, when matters are so far changed, that the tumor is attended with much pain, and daily becoming larger. In such circumstances, the sooner the diseased parts are removed, the greater will be the chance of a recovery; so that not a day should be lost: for, whatever the opinion of the late Mr. Sharpe on this point may have been, as well as of some others who appear to have copied from him, it has long been a fixed maxim with the most experienced surgeons, that, in all cases of cancer, the risk of a relapse after the operation, is commonly in proportion to the duration of the disease.*

The extirpation of the testicle being resolved on, the method of doing it is this: the patient must be laid on a table of a convenient height, with his legs hanging down, and firmly secured by two assistants on

* The opinion of the late Mr. Sharpe, on this point, was singular in a man of such extensive experience. He considered the risk of a relapse, after the extirpation of cancerous tumors, to be greater in the more early periods of the disease, than in their more advanced states. *Critical Inquiry*, 4th edit. p. 108.

each side ; one at each arm, and another supporting each leg. The parts being previously shaved, if the tumor is large, an assistant must be employed to secure it ; if only, however, of a moderate size, the surgeon will do it best himself. With one hand, therefore, he should grasp the swelling, so as to keep it firm, and with a scalpel in the other, an incision should be made along the whole course of it, beginning at least an inch above the part where the cord is to be cut, and continuing it through the skin and cellular substance, to the inferior part of the scrotum. The easiest method of doing it, both for the surgeon and patient, is by one continued stroke of the knife, as it is both more quickly and more neatly performed in this manner, than in the usual way of pinching up the skin between the finger and thumb, before cutting it ; and there is no kind of difficulty or risk in doing it in this manner.

The spermatic cord being thus laid bare, the surgeon, with the finger and thumb of one hand, should raise it from the parts beneath, so as to be enabled to pass a broad waxed ligature round it ; which is easily done with a large curved needle, or even with a blunt probe, with an eye at one end. With this ligature, a running knot should be made upon the cord, about half an inch above where it is to be divided.

The cord being at this part cut across with the scalpel, the testicle is then to be entirely removed, by dissecting the cord and it from above downwards, so as to separate them as easily as possible from the surrounding parts, without injuring the sound skin with which they were covered. Different instruments have been proposed for facilitating the separation of the testis from the contiguous parts ; but none with which we are acquainted answers the purpose so well, or with such expedition as a scalpel.

When the diseased parts are removed, any arteries of the scrotum that have been divided, should be first secured with ligatures, by means of the tenaculum. This being done, the spermatic artery and vein should

be gently separated from the nerve with which they are in contact, and, by the aid of a tenaculum, should be tied with a small ligature of waxed silk. By including the nerve in the ligature, as is commonly done, we render this the most painful part of the operation, while no advantage whatever is gained by it.

The ligature previously passed round the cord, should be untied ; but it should not be withdrawn. Lest the ligatures of the spermatic artery and vein should give way, this ligature should be allowed to remain during the first eight or ten days of the cure, and, being perfectly loose, no harm can be done by it. It is meant merely as an additional security, and to serve as a kind of tourniquet, in the event of any hemorrhage taking place ; so that, in circumstances such as we are now considering, it ought always to be left loose. There is, in fact, no more necessity for allowing this ligature to remain tied, than for leaving a tourniquet firmly applied upon any of the extremities after the operation of amputation ; and yet, instead of one ligature, such as this, it has been the practice with many to apply two, about half an inch distant from each other ; and these they leave firmly tied upon the whole substance of the cord during the cure of the sore.*

There is, however, no necessity for this precaution, as all manner of risk may be prevented, by securing the blood vessels in the manner I have pointed out. I have often done the operation in this way, and no hazard has ever ensued from it. By leaving the ligature at the upper part of the wound untied, it may be made use of, as I have already observed, to compress the cord, in the event of the blood vessels bursting out again ; but, when the ligature upon the spermatic artery and vein is properly applied, this will never happen ; and when it occurs from neglect or mismanagement, any severe hemorrhage may always be prevented by the ligature left for that purpose.

* Even the late Mr. Sharpe gives these directions. Vide *Treatise on the Operations of Surgery*, 10th edit. p. 55.

On the arteries being tied, the edges of the cut should be laid together, and secured with adhesive plaster, when the retraction is inconsiderable; and, with the interrupted suture, when it appears from the retraction that takes place to be necessary. At the same time, care should be taken to leave the ends of the ligatures employed for securing the blood vessels, hanging out at the edges of the wound, to admit of their being withdrawn, when, in the course of the cure, they appear to have become loose. The whole scrotum should be covered with a pledget of soft linen, spread with saturnine cerate; and a cushion of tow, covered with old linen, being laid over it, the whole should be secured with a suspensory bag, or the T bandage.

At the end of the second or third day, the dressings should be removed: it is easily done, when the parts are covered in the manner I have advised, with cerate; and it always keeps the patient more comfortable than when the first dressing is long delayed. For the same reason, the dressings should be renewed daily. In the course of eight or ten days, the ligatures commonly separate, and are easily taken away. About the same period, the ligature passed beneath the spermatic cord may be withdrawn; and by the fourteenth or fifteenth day, the cure, when conducted in this manner, is for the most part complete.

Hitherto we have been supposing that the teguments covering the testicle are sound, in which case none of them should ever be taken away; but, when the skin has become thin and inflamed, and especially when any of it is in a state of ulceration, all such parts of it should be removed along with the testicle. In such circumstances, the best method of doing the operation is this: instead of a longitudinal cut along the course of the testicle, the first incision should be carried in a straight line to the under extremity of the spermatic cord, from whence two semilunar incisions should be continued to the under part of the scrotum,

and in their course, be made to include all diseased parts of the skin.

The remainder of the operation should be finished in the manner that I have described, and the skin included in the two semilunar cuts not be dissected off by itself, but removed along with the testicle.

Even where a large portion of the teguments have been removed, the fore may be covered with skin; nor should this ever be omitted, when we find it can be done; for it not only hastens the cure, but serves as a more firm protection to the end of the spermatic process, septum scroti, and contiguous parts, than the new scarf skin, with which alone they would otherwise be covered. But when the remaining teguments will not stretch so much as to admit of their being retained either with plasters or sutures, the cure must necessarily be conducted in the usual way, by dressing with pledgets of any emollient ointment, till a cicatrix is induced. The advantages however, that we derive from being able to cover the fore entirely with skin, are so great, that every operator should keep it anxiously in view; for, besides those I have mentioned, it saves a great deal of pain and confinement, to which the patient must otherwise submit. It admits, indeed, of a cure in the fourth part of the time commonly required when the edges of the skin cannot be kept together.

From the descriptions usually given of castration, we would be induced to consider it as one of the most simple, as well as the most easy in surgery; and it must be admitted, that in the early stages of a sarcocoele, scarcely any difficulty ever attends it. But it is right that the younger part of the profession should be informed of what all practitioners of experience know, that scarcely any operation is productive of more perplexing occurrences in the advanced periods of the disease.

When the spermatic cord is so much diseased, that we are obliged to divide it near the abdominal mus-

cles, if the upper part of it is not previously secured with a ligature, it is apt to retract within the abdomen, so as to render it impossible to secure it in any other manner than by dividing the abdominal muscles. Of this I have now been present at two instances, in both of which the cord retracted suddenly with a smart jerk, instantly on being divided.

In one of these cases, no ligature had been applied, as the assistant imagined that he could secure the cord between his finger and thumb till the spermatic artery could be tied, but in which he was mistaken; and in the other, the ligature not being tied sufficiently tight, it slipped off from the end of the cord; and in both instances, the patients died of the hemorrhage. External pressure was the only remedy that could be employed; but although in both instances it gave, from time to time, a temporary check to the discharge, it did not, in either case, prove effectual; so that after various returns of the hemorrhage, the patients were at last carried off by inanition.

In all cases, therefore, where the cord must be cut in the upper part of it, a strong ligature should be previously firmly tied, as far as possible above the part in which the division is to take place. It should be applied with a running knot, and left of such a length as to admit of the ends of it hanging freely out of the wound. Being made with a running knot, it may be easily undone, whenever it may be supposed that no hemorrhage will occur on its being withdrawn; and if the end of the ligature is twice passed through the first noose, it will be sufficiently firm.

The pain attending this mode of applying the ligature, is, no doubt, much more severe than when the nerve is avoided; but in the situation to which I allude, where the cord is cut near to the abdominal muscles, this cannot with safety be done, and should not therefore be attempted.

In considerable enlargements of the testis, the tumor is apt to press so much upon the septum scroti,

and in some instances, adheres to it so firmly, that the cavity of the tunica vaginalis of the opposite side is sometimes opened in the course of the operation. Of this I have been present at different instances : in some no inconvenience ensued from it ; but in others, inflammation to an extensive degree, was induced in the corresponding testicle. With sufficient caution, however, in the removal of the tumor, all this may be prevented ; for, however large it may be, the dissection may be always accomplished without perforating the septum. When it is perceived, however, that an opening is by accident made in it, in order to prevent that inflammation of the testis which free access of air very seldom fails to induce, I would advise the divided parts to be neatly and gently drawn together with a ligature, in such a manner as to admit of its being easily withdrawn in the course of the cure. By this, we also prevent blood and matter from finding access to the tunica vaginalis.

But the most distressful part of this operation arises from that enlarged state of the arteries of the scrotum, which takes place in every instance where the tumor has acquired a great bulk, and from which practitioners occasionally meet with more embarrassment than is usually experienced in any other operation. Instead of one, two, or three arteries, very inconsiderable in size, which in the first stages of the disease, are all that we perceive ; in the more advanced states of it, we sometimes meet with six, eight, or even more, and all or many of them, of such a size as to require immediate attention.

In this period of the disease, the patient is commonly weak and delicate ; so that not being able to bear the loss of much blood, his strength would sink, if arteries of the size which these often acquire were allowed to bleed during the remainder of the operation. During the removal of the tumor, one or more assistants should be employed for the sole purpose of putting a stop to the discharge, by placing a finger

upon every artery, as soon as they perceive it to be cut ; nor should the pressure be removed till the dissection is finished, and the surgeon in readiness to secure the bleeding vessel with a tenaculum and ligature. This being done over the whole surface of the fore, he next proceeds to tie the spermatic artery, and to finish the operation in the manner I have mentioned.

From want of this attention, I have known such quantities of blood lost, as have either proved quickly fatal, or induced such debility and relaxation, as the patient never recovered from ; and as I have in different instances known even surgeons of experience fail in the proper management of this part of the operation, I think it right to say, that the younger part of the profession cannot be too much on their guard in performing it.

Besides the common form of sarcocoele, of which I have thus given an account, we find, that in workers among foot, the testis is liable to be attacked with cancer that first begins in the scrotum.

It first appears on the anterior and under part of the scrotum, sometimes in the form of a warty excrescence, and in others of a foul, superficial ulcer, with hard retorted edges. From the suspicious situation of the fore, and from the appearances which it exhibits at first, it is often suspected to be venereal ; but no advantage is derived from mercury, nor from any dressings that are employed. If not prevented by early extirpation, the ulcer spreads over the scrotum, and from thence to the testis, spermatic cord, and inguinal glands ; giving to the parts that it attacks all the ordinary and characteristic marks of cancer.

This variety of cancer appears obviously to be produced by foot ; for it is found, that, besides chimney sweeps, those who are employed in manufactures in which foot enters as an ingredient, are occasionally seized with it. And it also appears, that the foot acts altogether locally in producing it ; for, when the fore

is extirpated early, that is, soon after it has appeared, and before it has spread over any great extent of surface, the disease seldom returns, either there or on any other part.

As no other remedy has been discovered, for none that I have either tried or heard of has any influence in curing the fore, I would therefore advise the diseased parts to be extirpated as early as possible. This, while the ulceration is confined to the scrotum, is easy both to the patient and surgeon, when compared with the operation of castration, which must always take place when the testis becomes diseased, and is therefore a strong inducement for our insisting that no time should ever be lost in putting it in practice.

I may further observe, that arsenic, caustic, red precipitate, corrosive sublimate, and other irritating applications, produce the same effects in this as in other varieties of cancer.

When applied so as to remove the diseased parts entirely, they perform with much more pain, and in a much more tedious manner, what may be more neatly done by the scalpel at once: while, so far as I have observed, none of them are productive of any other advantages, at the same time that, by the irritation which they excite, they very frequently do much harm.

Many accounts have been communicated to the public of this and other varieties of cancer being cured by escharotics of different kinds, and chiefly by arsenic, which appears to form the basis of a great proportion of the remedies of this class, that have been employed for the cure of this disease. But, while all of these, as well as the internal use of hemlock, and of every other medicine I have known employed, have failed in every instance, they have very commonly had the effect of amusing the patient with hopes of a recovery, till it has been too late even for the extirpation of the diseased parts to prove successful.

I have, therefore, no hesitation in asserting, that the operation should be advised in the early stages of the disease, and that no other remedy, with which we are yet acquainted, should ever be relied on.

Besides those affections of the testes and their coverings, that I have described, there is another, that seems to be peculiar to warm climates. It is met with frequently on the coast of Africa, and in the West Indies, in some instances in Europeans, but chiefly in negroes.

An uniform, firm, colourless swelling attacks the whole substance of the scrotum. It is seldom, for a considerable time at first, accompanied with pain; but, when it passes from the cellular substance of the scrotum to the testes themselves, which, in some instances, happens, it, in this state, always excites a great deal of distress.

In the early stages of the disease, the external application of astringents, accompanied with a course of mercury, has, in some instances, proved useful. But, when the tumor has become large, a cure has never been obtained of it. In this situation the patient obtains no relief, but from a proper application of a suspensory bag, and, in severe degrees of pain, from large doses of opium.

CHAPTER XXVIII.

OF THE DISEASES OF THE PENIS.

SECTION I.

Of the Phymosis.

THE glans penis is naturally provided with a covering termed the preputium; formed by an elongation and doubling of the skin. This in a healthy state is in general of such dimensions as to pass easily over the glans, but by disease it is frequently prevented from doing so; and when the prepuce has got forward, and cannot be drawn back over the glans, the disease thereby produced is termed a phymosis.

Phymosis is induced by whatever tends to swell the glans, or excite inflammation and stricture in the preputium: hence it is a frequent consequence of gonorrhœa virulenta, and lues venerea; and it sometimes occurs from want of cleanliness, particularly in those who are naturally liable to a plentiful exudation of viscid mucus between the glans and preputium.

Where the disease is slight, and not of long duration, fomenting the parts in any warm emollient decoction, commonly gives relief; or what answers better for such purposes than any decoction, is warm milk; this, together with the use of emollient poultices, with a view to relax the constricted preputium, often answers so effectually as to render other applications unnecessary.

At the same time that fomentations and poultices are advised, a weak saturnine solution should be injected from time to time between the prepuce and glans,

with a syringe, in order to wash away any matter which by its acrimony might tend to protract the disease.

When the parts are much inflamed, bloodletting often proves useful. When the superficial veins of the penis can be opened, any blood to be discharged should be taken from one of them by the lancet ; but when they do not appear conspicuous, taking blood from the arm will answer as well as from any other part : local bloodletting with leeches would be here particularly indicated ; but when the disease has arisen from lues venerea, the bites of these animals almost constantly terminate in troublesome sores. Together with a discharge of blood proportioned to the strength of the patient, gentle laxatives should be prescribed, a low diet, and abstinence from exercise.

When, however, it is found, that even a due perseverance in these means does not remove the disease, and especially if chancres are confined under the prepuce, which might injure the glans by the matter discharged from them not getting a proper vent, in that case it becomes necessary to remove the stricture by an incision carried along the whole course of the preputium.

As the skin of the prepuce is exceedingly lax, it is almost impossible to cut it with neatness and accuracy in the ordinary way, either with a scalpel or bistoury ; and when done in this manner, the skin yields so much before the instrument, as always to render the operation tedious and painful : neither are the probe scissors well calculated for doing it properly, as the parts are commonly so much thickened by inflammation, that they cannot be rightly cut with scissors.

These inconveniencies being obvious, many inventions have been proposed for doing the operation more easily. In Plate LXVIII. figures 1. 2. and 3. is represented an instrument which I made for this purpose several years ago, and it answers the intention very effectually, and with much ease.

It consists of a director, fig. 2. with a small curve at its extremity, to which a sharp pointed bistoury, fig. 1. with a narrow blade, is so exactly adapted, as in fig. 3. that the cutting part of it is entirely concealed in the groove of the director, which ought to be about a quarter of an inch longer than the blade of the knife.

The knife being inserted into the director, so as to be covered by it entirely, the instrument in this state is to be passed between the prepuce and glans on one side of the penis, till the director is found by the finger to have reached the upper end of the preputium. The operator is now to keep the director firm with one hand, and with the other is to push the knife forward, so as to make its point pass through the prepuce; and the director being withdrawn, the operation is finished by drawing the knife forward, so as to make it divide the prepuce through its whole length along the side of the penis.

In this manner the preputium is preserved in a tense state, while the division is going on, by which means the operation is accomplished with ease: and, by dividing the preputium on one side, we more readily avoid the large veins of the penis, at the same time that the matter proceeding from the cut is more easily discharged, than when the operation is done on the back part of the penis.

The prepuce being thus divided, the parts should be bathed with warm water, so as to wash off any acrid matter with which they may be covered; and this being done, the fore should be covered with soft lint; and a compress of old linen being laid over it, the whole may be easily retained by a small linen bag adapted to the size of the penis, to be secured by two straps pinned to a circular bandage made to surround the body. This bag must indeed be always removed when the patient makes water; but this is easily done; and it retains the dressings not only more effectually,

but with more ease to the patient, than is done either with adhesive plasters or any other form of bandage.

In the after dressings of the fore, care should be taken to insert a piece of soft lint between the divided prepuce and glans, otherwise troublesome adhesions are apt to take place. I have met with several instances of this, which gave much distress to the patients, and which with due care and attention in dressing the fores, might easily have been prevented.

It is scarcely necessary to observe, that when any venereal infection subsists in the constitution, the fore produced by this operation will not readily heal, if the patient be not put under mercury. In such circumstances, therefore, if mercury has not been previously given, it ought always to be advised immediately on the operation taking place.

In some cases of phymosis, the preputium is so long that the operation of circumcision answers the purpose better than a longitudinal cut. And it is easily done, by taking away all the superabundant portion of the prepuce by one stroke of a scalpel. It sometimes, however, happens, when the operation is done in this manner, that the remainder of the preputium contracts so powerfully, as to produce a good deal of distress; which can only be obviated by due attention to the after treatment of the fore, and making use of emollients, instead of astringent applications during the cure.

SECTION II.

Of the Paraphymosis.

BY the term paraphymosis is meant a morbid retraction of the preputium, producing stricture behind the glans penis. This disease, like the former, is a frequent symptom in the venereal disease: but it

will arise from whatever tends to produce, either a preternatural fulness in the glans, or a constriction of the prepuce; and more especially from such causes as induce a complication of both.

In the incipient state of paraphymosis, we may often with due dexterity and attention bring the prepuce over the glans, by pushing the glans gently back with the thumb of each hand, while with the fingers we draw the prepuce easily forward. In the more advanced state of the disease, however, no attempt of this kind should be advised, as it is in its commencement only that it ever succeeds; and when it does not prove useful, it is apt to do harm, by inducing an increased degree of irritation in the parts to which the pressure is applied.

As the paraphymosis seems to be more frequently induced by an enlargement of the glans than by any original affection of the prepuce, so the stricture in the prepuce is not here so completely relieved by emollient fomentations, as it commonly is in phymosis, where the disease is most frequently produced by a stricture of the prepuce alone. In paraphymosis, indeed, warm emollients seem rather to do harm, as they tend evidently to increase the swelling in the glans, by which the stricture in the prepuce is always proportionally increased.

Nothing in general answers so well here as saturnine applications. The swelling, indeed, will often subside by being frequently immersed in a cold solution of saccharum saturni, when all other remedies fail. But, when the penis is evidently much swelled and inflamed, together with this application to the part, the patient should be kept cool; gentle laxatives should be prescribed, and blood be taken from one of the superficial veins of the penis.

By due perseverance in these means, and keeping the patient on low diet, the stricture is frequently removed. But, when the disease proceeds to increase, by the swelling in the glans becoming more consider-

able, and the stricture of the prepuce increasing, the preputium becomes œdematous, and unless relief be soon obtained by a complete removal of the stricture, gangrene of the glans very commonly ensues.

When, therefore, none of the remedies I have mentioned answer the purpose, we should endeavour to remove the stricture by an operation; and the easiest method of performing it is, with the shoulder of a lancet, or a small scalpel or bistoury, to make a deep scarification on each side of the penis, directly behind the glans; taking care to make each cut of about half an inch in length, and of such a depth as effectually to divide the prepuce just at the spot where the stricture is most considerable.

The parts should now be allowed to bleed freely, as this circumstance of itself in general affords relief; and as soon as the flow of blood is over, a pledget of any emollient ointment being applied to the sores, and a soft well made poultice being laid over the whole, if the scarifications have been carried entirely through the stricture, nothing further will be necessary than dressing the parts daily with the same ointment with which they were at first covered: but, if the scarifications have not been made of a sufficient depth, it may afterwards be necessary to renew them; when care must be taken that they are effectually done.

In the phymosis, I advised the patient to be put under a mercurial course whenever there is reason to suspect that he is infected with lues venerea; and the same precaution, it is evident, is equally proper in paraphymosis.

SECTION III.

Of Amputation of the Penis, &c.

THE penis, like other parts of the body, is liable to diseases, which in some instances render amputation necessary.

Thus, in some instances, it is attacked with gangrene, and in others with cancer, in both of which amputation is very commonly requisite.

I have elsewhere entered fully into the consideration both of mortification and cancer.* Referring, therefore, to the observations that I had there occasion to suggest, I shall at present only advert to the mode of amputating the penis when it becomes so diseased as to render this operation necessary.

A circular incision should be first made through the sound skin at the upper end of the diseased parts, when the skin being drawn back by an assistant, the body of the penis should be cut through by one stroke of the scalpel, care being taken to remove every part that appears to be diseased.

This being done, such arteries as bleed freely should be carefully searched for, and secured with ligatures. In general, two, and sometimes three arteries are met with; and they should all be secured in this manner. But even after the principal arteries have been tied, a considerable oozing of blood usually continues from the surface of the sore, which we sometimes stop by sprinkling the whole with starch or gum arabic in fine powder; but when this does not answer, a small silver canula being passed into the urethra, and retained with a bandage, any farther discharge of blood may be easily stopped by slight compression with a narrow roll-

* Vide Chap. I. Sect. IV. and Chap. V. Sect. VIII.

er on the parts that remain. A slight degree of compression answers the purpose, such a degree of it, indeed, as does not hurt the parts on which it is made ; and as the tube inserted into the urethra need not be long, it is easily retained during the whole course of the cure, without either inconvenience or distress.

In Plate LXVI. fig. 4. is represented a tube which I have in different instances used for this purpose. It is easily kept in its situation by fixing it with two ligatures, one on each side, to a narrow roller round the penis.

Heister, as well as others, being afraid of the hemorrhagy produced by amputating the penis, advise it to be done with a strong ligature. A ligature being applied with firmness above the diseased parts, they are thereby made to fall off in the course of six or eight days ; but whenever a part can be easily removed with the scalpel, it is done with much more ease and expedition than in any other manner.

Others, again, have said, that no danger is to be dreaded from any discharge of blood that can ever ensue from amputating the penis ; but this I know from experience is not the case. In the course of a few months, I had occasion to perform this operation three different times in the Royal Infirmary here ; and, in the first, I was persuaded by a gentleman who had found it in one case to succeed, not to secure the arteries with ligatures, but to trust to compression alone. This was accordingly done ; but unfortunately, in the course of an hour or two after the operation, such a profuse hemorrhagy supervened as terminated in the patient's death.

In the next, I was resolved to secure every branch of an artery that could be laid hold of. Three different arteries were accordingly tied, and no hemorrhagy ensued. In the third operation, two branches of an artery were secured ; but a plentiful oozing still continuing from the fore, the silver tube above mentioned was introduced into the urethra, and a slight com-

pression being made upon it, the discharge was immediately stopped. In no other instance of my performing this operation did any dangerous hemorrhagy take place, and I have done it in a great many.

When all the arteries, for we frequently meet with three or four, have been secured in this manner, the parts should be covered with pieces of soft lint sprinkled with starch or gum arabic in powder ; and a compress of linen, with a hole in it large enough to pass over the canula in the urethra, being laid over it, and the T bandage being employed to retain it, all the dressings may in this manner be secured ; while the after treatment of the fore should be similar to that of wounds in any other part.

In proceeding to this operation, it ought to be kept in view, that the prepuce is frequently so much enlarged and ulcerated, as to give cause to suspect that the glans as well as the rest of the penis is diseased, when in reality they are perfectly sound. I was once present at an operation, where the previous appearances were such as gave no reason to doubt of the glans being diseased ; the prepuce, with part of the penis, was accordingly taken off ; when it afterwards appeared that the glans might have been saved, as the disease was found to be confined to the prepuce alone.

In every case, therefore, where we are not absolutely certain of the glans being affected, all the diseased preputium should be first removed ; and the state of the parts below being examined, if they are found to be so much diseased as to render it proper to remove them, it can be then done with as much ease as if they had been taken off along with the prepuce ; while, on the contrary, when they appear to be sound, the surgeon as well as the patient will have much cause to rejoice.

It sometimes happens, that the frenum penis is so short as to excite much uneasiness when the parts are in a state of erection. But as no danger ensues from

a division of this ligament, whenever it proves troublesome, it ought to be cut across; and it is easily done with probe pointed scissars: after the frenum is divided, a bit of soft lint should be inserted between the lips of the wound, otherwise the parts newly separated will be apt to reunite.

In some instances, the urethra in male children is incomplete, and terminates before it reaches the point of the yard. In others no external opening can be discovered, while in many the urethra terminates in a small opening, not large enough to admit a small pin head, at some distance from the end of the penis.

When no opening is discovered, if the urine is found to stop at any particular part, the introduction of a small trocar from the point of the yard along the course that the urethra ought to take, and carrying it forward till it meets with the urine, will give immediate relief; and by the use of small bougies, the sides of the passage may be rendered callous, and a clear opening preserved. But when any opening is discovered, although it should not be properly placed, if it affords a temporary passage to the urine, it is better to delay the operation till the patient is advanced in life; and on an opening being then made with a trocar in the manner I have mentioned, a piece of flexible catheter of *resina elastica* may be introduced, not only for preserving the passage free and pervious, but for carrying off the water till a cure is obtained. In the earlier periods of childhood, the smallness of parts through which a catheter ought to pass, renders the use of this instrument altogether inadmissible.

Besides the affections of the penis that we have been just considering, fistulous openings frequently form in the urethra, and they always give much distress. These however, as well as the treatment of stones impacted in the urethra, will fall to be considered hereafter.

CHAPTER XXIX.

OF THE STONE.

SECTION I.

General Remarks on Urinary Calculi.

PARTICLES of stone have been known to form in almost every cavity of the body, but more frequently in the organs of urine than in other parts.

The blood, as well as the secretions which it affords, are, by experiment, found to contain a large proportion of earth : when this earthy part of our fluids is in the usual quantity, and when not separated by disease, it continues to circulate along with the other parts of which these fluids are composed ; and in this state no harm ever ensues from it. Various causes, however, may concur to produce a deposition of this earthy matter from the blood and its secretions.

1. We know, that every liquid can dissolve and keep suspended a certain quantity, and no more, of those substances of which it is a menstruum ; and it is likewise known, when a greater proportion than this is added, that a separation and consequent deposition takes place of all the additional quantity. In like manner, we may suppose, if the lacteal vessels ever absorb a greater proportion of earthy matter from the contents of the intestines, than the quantity of fluids in the circulating system can keep suspended, that this superabundance of earth must necessarily separate from the rest ; and the depositions thus produced are much more likely to occur in the bladder and kidneys than in other parts, from the urine containing a larger proportion of earth than any other secretion.

2. Independent of other causes which may tend to induce a superabundant quantity of earthy matter in the blood, such articles of food as contain a large proportion of earth have been supposed to be more productive of it than others : but unless such quantities of earth as are contained in food, be conveyed in a state of the most perfect solution, any effect that may result from it will not be important. There is much reason, however, to think, that a long continued use, either of water, or of wines abounding with earth in a dissolved state, has a considerable tendency to produce that state of the blood to which I allude ; of which indeed, I could produce various facts that could not admit of dispute.

3. Those who are much accustomed to the use of solid food, will be more liable to the formation of a large proportion of earthy matter in the blood, than those who by a free use of liquids are in the habit of preserving a more plentiful and more diluted state of the secretions. And accordingly, in those who frequently void particles of sand, and even small calculi, I have known more advantages derived from a continued and plentiful use of diluent drinks, than from any other remedy. A liberal use of watery fluids may, no doubt, operate to much advantage, by washing away particles of sand and stone already formed and lodged in some of the organs of urine ; but they seem likewise to prove useful, merely by their diluent properties in preventing their formation.

4. A superabundance of earthy matter being once produced in the blood, various circumstances may concur to form depositions of it in the different cavities : of these a sedentary life is, perhaps, one of the most remarkable ; and hence it probably is, that such people are found to be most liable to calculous complaints, whose occupations require the least bodily exertion.

It must indeed, be allowed, that stone in the bladder is frequently met with amongst indigent and in-

dustrious labourers ; whose necessities, at all times, prevent their indulging in indolence. In such instances, however, it may be supposed, that the very coarse articles of food, with which people in this line of life are chiefly nourished, will tend to impregnate the blood with such a large proportion of earth, as must necessarily produce effects not to be obviated, even by the beneficial influence of a continued and regular course of exertion.

5. Whatever influence a predisposition in the system may have in the formation of calculus, and in its subsequent increase of bulk, the introduction of any substance that can serve as a nucleus, will almost certainly produce a stone, in whatever cavity it is lodged. Thus, a particle of sand, of blood, or coagulable lymph, may in consequence of spasm or inflammation, be confined in the pelvis of one of the kidneys, or in the cavity of the bladder, and may soon acquire such a size, from the constant addition of earthy matter that it receives, as to make it impossible for the urine to carry it off: and urinary calculi, thus begun to be formed, will acquire, sooner or later, a considerable bulk, according to the quantity of earth with which the urine is impregnated. Thus instances have occurred, of stones becoming large, in the space of a few months from the first obvious symptoms which they produce ; while at other times, they have been known to remain in the bladder for a great many years, without arriving at any size of importance.

When speaking of nuclei, it is necessary to remark, that their effect in the formation of calculi, in the urinary passages especially, appears to be so great, that it may be doubted whether a stone is ever known to form in these parts without the intervention of this cause ; for, however large the quantity of earth contained in urine may be, it would probably all flow off by the urethra, if it was not detained by the accidental introduction or formation of a nucleus,

Nuclei of different kinds, such as hairs, needles, musket and pistol bullets, pieces of bougies, and a variety of other articles, have been met with in the centre of urinary calculi ; but particles of blood, or of coagulable lymph, are most frequently found to produce them.

By the difference of food used at different periods of the disease ; by the stone being formed slowly or more quickly ; and perhaps, by the intervention of other causes which are not always known, and which if known, could not be easily explained ; it commonly happens, that the different lamellæ of which human calculi are composed, vary considerably both in colour and consistence ; a crust of a soft friable nature being frequently known to cover one of a texture equal in hardness to the most solid marble ; while this again is found to surround a stratum not firmer than a piece of dough.

Whatever may be the immediate cause of this difference of consistence in stones, and even of different parts of the same stone, is of little importance in practice : but we know from experience, that the symptoms produced by calculi formed of hard compact materials, are in general more severe than such as arise from those of a softer texture ; and we likewise know, that the surface of stones being smooth or ragged, has much more influence than any other circumstance in the violence of the symptoms which they produce : much variety too, it may be remarked, is met with in human calculi with respect to the smoothness of their surfaces ; some being perfectly polished, while others are covered with hard sharp points.

The violence of symptoms in this disease, is commonly in proportion to the size of the stone ; stones of the greatest bulk being for the most part attended with the most severe pain. This, however, is not always the case ; for instances sometimes occur of the most severe symptoms being induced by small stones ; whilst in others, stones of a considerable size have

been known to subsist for a great length of time without inducing much pain : but in general it is otherwise, and the symptoms are most frequently mild or severe, according as the stone by which they are produced is small or large.

When a stone has acquired such a size that it cannot pass off from the bladder, the patient becomes liable to symptoms which from their commencement give much uneasiness, and which, in the event, commonly terminate in the most afflicting scenes of distress to which the human frame is liable.

One of the first symptoms of stone, is an uneasy sensation at the point of the yard, which for some time is only discovered on the patient taking violent and jolting exercise, or immediately after voiding urine. This pain by degrees becomes more frequent and more severe. The patient has a strong propensity to pass urine frequently, and commonly voids it in small quantities, perhaps even drop by drop.

When flowing in a full stream, it often stops suddenly ; and this it is most apt to do when a considerable quantity is collected, and when of course the patient's desire for voiding it is strongest. Nor does the pressure usually made by the patient answer any good purpose : for, as the interruption to the flow of urine proceeds from the weight of the stone bearing against the neck of the bladder and orifice of the urethra, nothing will produce a free return of it but an alteration in the site of the stone, which more readily happens from the patient changing the posture of his body, and particularly by the pelvis being more or less elevated, than by all the pressure that he can employ for forcing it out.

The urine of calculous patients is often perfectly clear, but most commonly thick, and deposits a mucous sediment ; and not unfrequently, when the disease is violent, and the paroxysms frequent in their return, it is tinged with blood. When the stone is large, a dull uneasy sensation takes place about the

neck of the bladder ; and the irritation produced by it frequently excites a tenesmus, or a constant and painful desire to go to stool.

All these symptoms are commonly increased by exercise, particularly by riding on horseback ; and from a long continuance of pain, and from that want of rest which frequent returns of the paroxysms induce, the patient's state of health by degrees becomes impaired ; and unless the stone is removed, it commonly happens that his misery is only terminated by death.

When all or most of the symptoms that I have enumerated, occur in the same patient, there can be no great reason to doubt of the cause by which they are produced ; and we know with certainty that they proceed from calculus, when fragments of stone, or sundry small stones, continue to pass from time to time along with the urine : but when this does not occur, we can never with certainty know whether the symptoms arise from stone or not ; for instances frequently happen, of all the symptoms usually produced by stone in the bladder, arising from an ulcer or tumor either in the bladder itself, or in its neck, or even from tumors on the contiguous parts when they press either on the bladder or on its neck.

Practitioners accustomed to this branch of practice, will in general be able to judge from the symptoms, whether a stone actually exists in the bladder or not ; but the only certain means by which it can be ascertained, is through the intervention of a sound or curved probe ; different sizes of which are represented in Plate LXIX. By passing this instrument into the bladder, in the manner I shall presently mention, if it touches a stone, such a sensation is thereby communicated to the operator, as gives ample conviction of the real cause of the disease.

SECTION II.

Of Sounding or Searching for the Stone.

BEFORE describing the operation of sounding, it will be proper to give an anatomical description of such parts as are concerned in it; and to this I shall add an account of those parts that are most immediately injured by the various operations of lithotomy: these are, the kidneys, ureters, urinary bladder, pelvis, vesiculæ feminales and their ducts, prostate gland, urethra, penis, some of the muscles of the penis, and part of the abdominal muscles.

A minute description of these parts would lead to an extensive discussion, inconsistent with the nature of this undertaking; and as such a description is not necessary, I shall only give such an account of the parts as may serve to render intelligible the description to be afterwards given of the operations to be performed on them.

The kidneys are two glandular bodies lying in the back part of the abdomen, on the upper part of the psoæ muscles; the right being seated immediately below the great lobe of the liver, and the left under the spleen; and they are both, I may remark, almost completely covered by the slight curvatures of the inferior false ribs. They are supplied with blood vessels, termed the emulgent arteries and veins, directly from the trunks of the aorta and vena cava. The use of these organs is to separate the urine from the blood, which, as soon as it is secreted, is carried by means of two canals or tubes, one from each kidney, termed the ureters, directly to the vesica urinaria. The ureters, after leaving the kidneys, proceed obliquely downwards behind the spermatic vessels, over the os sacrum; and passing in between the bladder and rectum, they are inserted into the former near to its neck, at a small

distance from one another ; and after piercing the external coat of the bladder, they run obliquely for a short space between it and the more internal covering of that organ before penetrating its cavity : a construction well calculated for preventing a reflux of urine to the kidneys.

The pelvis is a kind of box or basin, formed by a conjunction of the os sacrum, os coccyx, and ossa innominata. The cavity formed by a particular combination of these parts, being intended for the protection of the bladder, and some other organs, is everywhere surrounded with bone, or with strong ligaments, except at its upper and inferior parts, where alone the pelvis is accessible, being here covered with soft parts only. The cavity of the pelvis is chiefly occupied by the bladder, which, when in a distended state, fills it entirely, and even ascends considerably above its brim.

The bladder, or receptacle of the urine, is a membranous bag composed of different coats, one of which is evidently muscular, with its fibres running in different directions. The human bladder is of an irregular oblong figure. The superior part of it has commonly been termed its fundus, or bottom : the opposite extremity, lying at the bottom of the pelvis, is termed the cervix or neck ; and the intermediate space, its middle or body. The bladder is everywhere nearly, though not exactly, of the same diameter, except at its fundus, where it is somewhat contracted ; and again near to its neck, where it dilates considerably, extending back towards the coccyx.

The superior part of the bladder is covered with the peritonæum ; and it therefore lies, along with the other abdominal viscera, within the abdominal cavity ; but the under part of it is not covered with that membrane. The anterior under part of the bladder is connected by cellular substance to the pubes ; laterally, it is fixed by productions of its external covering to the other bones of the pelvis ; and posteriorly, it is in male subjects firmly connected with the rectum, from

the entrance of that gut into the pelvis, till within a little of its termination in the anus, when the neck of the bladder and commencement of the urethra separate a little from the gut, leaving a space that is filled with fat and cellular substance.

In females, the uterus, in an unimpregnated state, lies altogether in the cavity of the pelvis, immediately behind the bladder; and the vagina, in which the os tincae terminates, lies directly behind the urethra, and before or upon the intestinum rectum, to which it is firmly attached.

The neck of the bladder terminates in the commencement of a cylindrical membranous canal, the urethra, which comes off at nearly a right angle from the anterior part of it. The urethra, at its commencement, is surrounded by the prostate, a gland of a flat pyramidal shape, with its base towards the bladder, and its apex pointing to the perinæum; its superior lamella being connected with the pubes, and its inferior part with the anterior and under part of the rectum.

The urethra continues to be entirely membranous for a short space after it leaves the apex of the prostate gland; and this part of it keeps in close contact with the ossa pubis, till it passes out from below the arch formed by these bones, which it does by making a curve in its progress to the perinæum. This curvature in the urethra it is material to be well acquainted with, particularly in the operation of sounding. A good anatomist will in general pass a staff with ease, while those not versant in the anatomy of the parts concerned, are not only apt to fail entirely, but are sure to give much unnecessary pain.

The commencement of the urethra, that I have just described, is termed the membranous part of it; which, before it has proceeded an inch from the extremity of the prostate gland, is surrounded by a cellular kind of body, termed the corpus spongiosum urethræ, which here forms a kind of protuberance, termed the bulb

of the urethra ; and which afterwards proceeds along in a more diffused state to the extremity of the penis, where, by expanding again, it terminates in the formation of the glans penis.

The rest of the penis is formed of the preputium, which, as I have already had occasion to observe, is merely a doubling of the skin ; and of two round cavernous bodies, termed the corpora cavernosa penis, which originate by two crura or legs from part of the os ischium and posterior part of the pubes on each side ; and having united near the symphysis pubis, they thus form the principal part of the body of the penis, and are continued to the glans, with which they are connected, but with which the cellular or cavernous parts of these bodies have no direct communication.

By the junction of the two cavernous parts of the penis, which are nearly round, a kind of hollow is formed both above and below. In the former of these, or in that vacuity which runs along the back part of the penis, the principal veins of the penis run ; and the urethra is protected by the latter. The obvious use of the urethra is to serve as a passage for the urine and semen ; the receptacle of the former I have already described, and I shall now mention those of the latter. The semen, after being secreted by the testes, is by two very small tubes, termed vasa deferentia, lodged in the vesiculæ feminales, which are found to be two cellular kinds of canals, contorted in such a manner as when distended to resemble the intestines of a small fowl. They are seated on the posterior part of the neck of the bladder, below the entrance of the ureters, and lie in close contact with the rectum ; and the semen is again discharged from these receptacles by two excretory ducts, which terminate in two points, at a part which, from its figure, has been termed the caput gallinaginis, situated on the inferior side of the urethra, nearly about the middle of the prostate gland ; and a little below the entrance of these canals from the

vesiculæ feminales, the two excretory ducts of the prostate gland empty themselves into the urethra.

The muscles that are cut in the lateral operation of lithotomy, now commonly practised, are the *erectores penis*, *acceleratores urinæ*, *transversales perinæi*, and *levator ani*. The *erector penis* arises from the tuberosity of the ischium; and, after covering almost completely the crus penis of the same side, it is inserted by a tendinous expansion into the superior part of the penis, near to where it joins with its fellow of the opposite side.

The *accelerator urinæ* arises by fleshy fibres from the sphincter ani and contiguous soft parts; and after covering the membranous part of the urethra, it is inserted into the middle of the bulb, where it joins with a similar muscle of the opposite side: part of these muscles, too, run along the crura penis, and are afterwards lost in the ligamentous covering of the corpora cavernosa. The *transversales perinæi* are two thin narrow muscles, which originate from the firm membranous covering of the tuberosity of the ischium, and, after stretching directly inwards, are inserted into the bulb of the urethra.

Besides these muscles, which all suffer more or less in the lateral operation of lithotomy, the *levator ani* must necessarily be cut in the same operation; and in the high operation for the stone, part of the *musculus transversalis abdominis*, of the *rectus*, and *pyramidalis*, are also cut.

Almost all these parts are furnished with blood by branches from the internal iliac artery; and those vessels which run most hazard of being cut in the lateral operation for the stone, are, the *arteria pudica interna*, and the *pudica externa*; for, the former supplies not only the parts about the anus, but the bulb of the urethra and the corpora cavernosa; and the latter, to wit, the *pudica externa*, supplies a great part of the bladder, the prostate gland, and *vesiculæ feminales*.

Having thus premised all that is necessary for our purpose, of the anatomy of these parts, I shall now proceed to the operation of sounding.

For the purpose of discharging water collected in the bladder, a curved silver tube is made use of, named a catheter, different forms of which are delineated in Plates LXXI. and LXXII. But for the discovery of a stone in the bladder, a solid instrument made of steel is preferable, as the sensation communicated by a firm substance is more distinct than when an instrument of silver, or any other softer material, is employed. In females, the urethra runs almost in a straight line; so that an instrument, either perfectly straight, or nearly so, such as is represented in Plate LXXI. fig. 3. is more easily introduced than one with a large curvature: but in male subjects, the turn made by the urethra, when it passes up between the rectum and pubes, is so considerable as to preclude entirely the introduction of a straight instrument, unless much violence is used. By preserving the penis at an acute angle with the body, the course of the urethra may indeed be rendered so straight, that a straight probe may be easily introduced, till it reaches this turn towards the farther extremity of the perinæum; but the curvature made by the urethra at this place, renders it necessary to employ an instrument with a corresponding degree of convexity.

The curvatures commonly given to these instruments are either too great or not considerable enough. Either extreme renders it difficult to obtain a passage into the bladder: for when the staff is made with too much convexity, besides being more difficult to introduce, it gives much unnecessary pain, by stretching and even tearing the urethra; nor can an instrument with much convexity, be so easily managed, when in the bladder, as when the curvature given to it is less. In Plate LXIX. sounds are represented of various sizes, and with such degrees of curvature, as by experience I have found to answer better than any other.

They are taken from the natural curvature of the urethra, the instruments from whence they are delineated having been exactly adapted to that passage, after the surrounding parts were removed.

The patient to be sounded should be laid upon a bed, with his head raised on a pillow, and his thighs somewhat elevated and separated from each other, in which position the muscles of the abdomen are put in a state of relaxation. The surgeon, if he employs his right hand to pass the staff, should stand on the left side of the patient, and the sound should be of a size proportioned to the passage intended to receive it. Having previously brought it to the heat of the patient's body by immersion in warm water, and having dipped it in fine oil, he is now to grasp the penis with his left hand; and, having introduced the end of the sound into the urethra, with its concave side towards the abdomen of the patient, he must push it easily on with his right hand, while he continues with his left to draw the penis gently forward upon the instrument.

The sound being in this manner carried a sufficient length, it will commonly slip easily into the bladder; but, occasionally, we meet with difficulty in passing it through that part of the urethra that is surrounded by the prostate gland, the instrument being apt to stop when it comes to this part of the passage; and here I must remark, that any force employed for pushing it further, should be applied with much caution. That part of the urethra immediately anterior to the prostate gland being entirely membranous and unsupported, if the sound at this part meets with obstruction, and if still pushed forward with much force, much mischief must necessarily ensue. In this manner the point of the instrument is often forced entirely through the urethra; by which, instead of getting into the bladder, it forms an artificial passage, either between the bladder and pubes, or between the blad-

der and rectum; an occurrence that always excites severe distress; and which, there is reason to fear, is, either from ignorance or inattention, much more frequent than it ought to be.

In order to guard against the dreadful consequences that result from this, as soon as it is found that the instrument does not pass easily along, the forefinger of the left hand, being dipped in oil, should be introduced into the rectum, when, by stretching the parts and elevating the point of the staff, while at the same time the instrument is pushed gently forward, we commonly procure an easy entrance into the bladder. By depressing the handle of the sound, we also elevate the point of it, and in this manner its entrance into the bladder is sometimes accomplished; but in general the introduction of the finger into the rectum answers the purpose.

Sounding is undoubtedly a very nice operation; and dexterity in performing it can only be acquired by much practice. Every student, therefore, ought to embrace all opportunities of practising it, first on the dead subject, and afterwards on the living; for every candid practitioner must acknowledge, that he has, in different instances, found the introduction of a catheter, or of a sound, both difficult and uncertain: but when the parts concerned are not inflamed, swelled or ulcerated, the operation does not often misgive in the hands of an expert surgeon.

The staff being introduced, the operator should lay hold of the handle with one hand; and if any part of it comes in contact with the stone, the business of sounding is accomplished; and we are thus rendered certain of the nature of the disease: but if the stone is not soon discovered, it may commonly be found by moving the instrument, so as to make its point pass easily from one side of the bladder to the other. When the stone, however, is small, and has fallen into that part of the bladder that lies below the entrance of the urethra, the staff is apt to pass over it. With

a view to obviate this difficulty, the finger of the left hand may be again introduced into the rectum, so as to elevate that part of the bladder in which the stone lies concealed. If, again, even this attempt should fail, the patient's body should be put into a different posture; and no situation will, in general, answer so well as lowering the head and upper part of the body, while, at the same time, we raise the pelvis. In this manner a stone, if not contained in a particular cyst, which it rarely is, may be moved from the projection at the neck of the bladder towards its fundus, where it will be more readily struck with the sound. But when, even by this posture of the body, we do not succeed, every variety of position ought to be tried: the patient's head may be elevated, and the pelvis depressed; he may be made to stand erect; or, what I have sometimes known to succeed after other attempts had failed, he may be made to stand upon his feet, with his body bending forward.

It sometimes, however, happens, when the stone is small, and the capacity of the bladder large, that our first attempt in sounding fails entirely; but when the symptoms of stone are strongly marked, and when schirrosity and ulceration of the parts, which might give rise to these symptoms, are not found to exist, we ought not to rest satisfied with one, or even with two trials. I have known a stone discovered on the third or fourth sounding, which had escaped the instrument in all the preceding trials.

When a stone is struck with the staff, the sensation it communicates to the operator is so peculiar, as to render it impossible for any to be deceived in it by whom it has ever been felt; but with those who have not been accustomed to this operation, a hardened state of the bladder communicates such a sensation through the staff, as frequently proves the cause of deception. This has even happened with practitioners of much experience and observation: it is reported of

the most celebrated lithotomist of this, or perhaps any other country, that, in the course of his practice, which indeed was very extensive, three patients were cut by him in whom no stones were discovered, and where a schirrous or hardened state of the bladder had given rise to the mistake.* With practitioners of experience, however, this can never happen but from inattention; for I will venture to affirm, that a person accustomed to the sensation communicated by a stone, can never, if he attends to what he is doing, be deceived by the application of the sound to a schirrous or any other tumor.

There being the least hazard, however, of such a misfortune as the one I have mentioned, namely, that of a patient being made to undergo all the pain and risk of the operation of lithotomy, when no stone has existed, is a point of such a serious nature, and fraught with such consequences, both to the patient, practitioner, and art of surgery, as ought to excite the most accurate attention to this part of the operation.

SECTION III.

General Remarks on the Operation of Lithotomy.

THE presence of a stone in the bladder being ascertained in the manner I have mentioned, the means to be employed for the relief of the patient, is the next object of consideration.

The public have at different periods been amused with encomiums on the lithontriptic powers of different articles, particularly of lime water, and of caustic alkali in a diluted state, and more lately of aerated alkaline water; but although some human calculi are soluble in all of these liquids, yet none of them can

* The late Mr. Cheselden.

be conveyed in such a state to the bladder as to be much depended on. Many indeed have obtained relief from the use of these remedies : the pain has, by their means, been rendered less severe, and the paroxysms less frequent ; but we have not one authenticated instance of a stone in the bladder being dissolved by the use of these, or any other remedy.

As the constituent principles of these and other lithontriptic medicines, render them liable to very material changes in their circulation from the stomach to the bladder, it has been proposed to convey them directly into the bladder itself, in order to bring them into immediate contact with the stone ; and machines have, accordingly, been invented for the purpose : but, after a great many trials have been made with remedies of this class, it seems now to be admitted, that no solvent, powerful enough to have any effect upon a stone, can be injected into the bladder, but with the greatest hazard of injuring that organ. But as some practitioners still continue to think favourably of it, I have given a delineation, in Plate LXXIV. fig. 1. of a machine by which liquids may with ease be thrown into the bladder. Every attempt, however, of this kind is now in general laid aside ; and as no dependence is to be placed upon the lithontriptic powers of any medicine taken by the mouth, the only resource we have is, the removal of the stone by a surgical operation. In this manner, if his constitution is sound, the patient may again enjoy as good health as he did before he was attacked with the disease ; and unless the operation is performed, the remainder of a miserable life will probably be cut short by the frequent returns of pain and fever, to which people in this situation are constantly liable.

We ought, however, to remember, that although a great proportion of those who are cut for the stone recover and do well, yet a considerable degree of danger always attends the operation ; so that, before advising any person to submit to it, such circumstances

ought to be considered with attention, as can best enable us to form a just prognosis of the event.

By experience it is found, that children more readily recover from this operation than adults; and it is likewise observed, that old people, from the fifty-fifth to the seventieth year, whose constitutions are not impaired, run less risk from it than men in the full vigour of life. This may possibly arise from the inflammatory symptoms which usually succeed to this operation, being more apt to proceed to a dangerous height in young plethoric people than in older patients; and we know from experience that more danger is to be dreaded from inflammation after this operation than from any other cause. But at whatever period of life the patient is, if he is otherwise healthy, more success is to be expected, than if his constitution had been previously impaired by frequent returns of the disease; especially when it has continued so long as to produce ulceration in any part of the bladder.

In an ulcerated state of the bladder, if the patient is advanced in years, he could not expect much enjoyment of life, even although he were to recover from the operation: in this situation, therefore, a prudent practitioner would rather decline to operate: instead of it, he would rather advise a plentiful use of mucilaginous drinks; an occasional use of the warm bath; together with doses of opiates proportioned to the degree of pain. By these means the violence of the pain is sometimes mitigated, and the patient is thereby saved from the distress of a severe operation, the effects of which, in a constitution such as I have mentioned, frequently prove fatal.

But even in these circumstances, if the patient is young, if he is suffering much from the disease, and if not so weak as to render it probable that the quantity of blood usually lost in the operation may irreparably injure his health; I would decidedly advise the operation. His chance of recovery will, undoubtedly, be less than if his health had otherwise been un-

impaired ; but, if he is lucky enough to survive the operation, he may enjoy life with comfort and ease.

The operation being resolved on, the next point to be determined is the best method of doing it. From the anatomical description that I have given of the parts with which the human bladder is surrounded, it appears, that there are only two points at which it can with propriety be laid open. A considerable part of the fundus of the bladder I have shown to be covered with the peritonæum ; so that to open it here, would be attended with imminent danger, from the certainty of exposing the abdominal viscera, not only to the effects of the atmosphere, but to the irritation of the urine, on finding access to the cavity of the peritonæum by the wound in the bladder. The posterior part of the bladder I have shewn to be either immediately covered with bone, or internally connected with parts which it would be highly improper to injure ; and these particularly are, the rectum ; the vesiculæ feminales ; and the vasa deferentia and ureters.

The only parts of the bladder, therefore, which can with a chance of safety be cut into, are, that portion of the anterior part of it, lying immediately below the peritonæum, and which, when in a state of distention, is raised somewhat above the pubes ; where an incision directly above the brim of the pelvis will lay that part of it bare where it is not covered with the peritonæum, and where, accordingly, an opening into it may be made : and, again, that portion of the bladder that we term its neck, which may be opened laterally by an incision in the perinæum, without any danger of wounding other parts of importance.

It is in one or other of these parts that any opening into the bladder can be made with safety. Some practitioners, indeed, have attempted to cut into it at the posterior part of its neck, or even into the body of it at once ; but the hazard of wounding parts of much importance is here so great, that for this and other reasons to be mentioned hereafter, every operation of

this kind is now laid aside. We shall presently, however, enter more fully into the discussion of this point, by giving a detail of the various means that have been proposed, from the time of Celsus downwards, for the purpose of extracting stones from the bladder; and this I shall do in the order of time that these operations were introduced into practice.

The distress and misery that urinary calculi excite, were probably experienced in the earliest ages of the world. Relief, we may therefore suppose, would be sought for, by the removal of the stones, as soon as such a knowledge of anatomy was obtained as could justify the attempt. We find accordingly, from the writings of Hippocrates, that even at this early period, the operation for the stone was frequently performed; but as it was then solely practised by a particular set of men termed lithotomists, we have received no account from this author of their method of doing it. Celsus is the first who describes the method of operating at the time when he lived; and it was done by making an opening in the body of the bladder, directly upon the stone itself. From the small number of instruments used in this method of cutting, it has been termed the operation by the lesser apparatus.

SECTION. IV.

Of the Operation of Lithotomy by the Lesser Apparatus.

THE person to be cut being properly secured, (the easiest and best method of effecting which, I shall describe in Section VII.) the surgeon must dip the fore and middle fingers of his left hand in oil; and having introduced them into the rectum of the patient, he is to search for the stone, and push it forward towards the perinæum, so that it may be felt between the scrotum and anus. In order to facilitate this part

of the operation, and to get the stone properly fixed, either the surgeon or an assistant should press with his right hand upon the under part of the abdomen, at the same time that the surgeon himself is pushing the stone forward with his fingers in the rectum, in which manner it is to be pressed forward below the pubes, and secured on one side of the perinæum, between these bones and the anus. This being done, we are directed by Celsus to make a semilunar cut through the skin, cellular substance, and muscles; beginning on one side of the anus, and carrying the cut directly over the centre of the tumor formed by the projection of the stone. The bladder being thus laid bare, a transverse incision is made through the coats of it directly upon the stone; when the stone, if it is small, may probably be turned out by pressure from behind with the fingers in the rectum; but if it is large, and does not come away easily, we are desired by Celsus to take the assistance of a hook for scooping it out.

This operation, with a few variations, continued, so far as we know, to be the only method of cutting for the stone, till the beginning of the fifteenth century, when another method of operating, to be hereafter described, was proposed, and very generally adopted. Long after this period, however, this operation of Celsus was still continued by many; and the ease with which it is accomplished, not only from the small number of instruments with which it is done, but from little or no anatomical knowledge being requisite, preserved it in constant use with itinerants, who continued, even to a late period, to practise it in different parts of Europe, under the name of the operation upon the gripe.

This method of cutting for the stone is indeed so easily performed, particularly in early infancy, that, even in these times, many of our well informed practitioners have a strong partiality towards it. At so late a period as the time of Heister, we find it was much in repute, insomuch that Heister himself per-

formed it frequently ; but a wrong representation has commonly been given of the parts that are cut in it ; for it has been commonly supposed, that by cutting directly upon the stone, the bladder itself must alone be wounded, while all the neighbouring parts of importance are imagined to escape unhurt ; a circumstance that would recommend it strongly, if, on experience, it was found to be the case. This, however, is far from being so ; as all who will make the experiment, will readily perceive.

A strict attention to the anatomy of the parts, might at once indeed convince us of the difficulty, if not of the absolute impossibility, of cutting from the perinæum directly upon a stone in the bladder, without destroying either the vasa deferentia, vesiculæ seminales, or excretory ducts of those receptacles ; the destruction of which would produce the usual effects of castration with as much certainty as a total extirpation of the testes themselves. These parts are all placed upon the under and back part of the bladder ; and as they, as well as the ureters, are immediately connected with that part of the bladder that is cut in this operation, it is perhaps impossible to perform it without dividing one or all of them.

As I had once a favourable opinion of this operation, I thought that in some instances it might be usefully employed, if, on experience, it should appear that these parts could be avoided with the scalpel. I accordingly put it frequently in practice on dead subjects ; but although in all of them it was done with every possible attention, it was constantly found either that the vesiculæ seminales were divided, or that their excretory ducts were cut across. This, however, was not all ; for although in some instances the urethra was not touched, yet in others it was found to be completely laid open before the scalpel reached the bladder. In every instance where the operation is performed in the manner directed by Celsus, the urethra must necessarily be cut, before the instrument reaches the

bladder. For it is altogether impossible to make a transverse incision into the bladder, in the manner advised by Celsus, without previously passing through part of the urethra; the farthest extremity of that canal being always pushed forward by the fingers in the rectum, in such a manner as to render it impossible to avoid it in this method of performing the operation.

But in most of the trials that I made upon dead subjects, for this purpose, I attempted what I consider as a material improvement of Celsus's method. A transverse or semilunar incision through the teguments and muscles, I believe to be better adapted than any other, for giving a free passage to the stone; but as the bladder is composed of a very dilatable membranous substance, there is no necessity for a transverse cut being made in it. After laying the bladder bare, therefore, by a semicircular cut along the course of the stone, instead of continuing the same kind of incision with which the operation commenced, a longitudinal cut was made directly on the centre of the stone, in order to avoid with as much certainty as possible all those parts that should not be injured. Even with this precaution, however, although the urethra was avoided, some of the other parts I have mentioned were always divided; so that although they may by accident, perhaps, be avoided once in a great number of times, I am confident that even the most expert anatomist would seldom be able to make an opening into this part of the bladder, sufficient for extracting a stone of a moderate size, without dividing either the vesiculæ seminales, the vasa deferentia, or their excretory ducts. In some instances, too, the entrance of the ureters into the bladder is so low down, as to render them liable to be cut in this operation. This, however, is a rare occurrence; but it has in some instances happened.

Another important objection to this operation is, that the bladder being pushed forward, and divided at a part that must afterwards recede from the wound in

the teguments, much risk must be incurred of the formation of sinuses, by the urine insinuating into the neighbouring parts; and we have to add to this, that in general this operation must be confined to the early periods of infancy. The readings of Celsus with which we are furnished, limit the performance of this operation to the age of ten, or from that to the fourteenth year; but this must surely be considered as an error in the late editions of that work, as this mode of operating is unquestionably better adapted for the earliest periods of infancy, than for the more advanced stages of it, inasmuch that it may always be done with more or less ease, in proportion to the thickness of parts about the rectum and bladder; and this, again, depends in a great measure on the age of the patient. We are told, indeed, of some practitioners who performed this operation on people of every age, of every habit of body, and whether corpulent or not. Such accounts, however, have never appeared to be authentic.

Among other improvements of this operation of Celsus, the use of forceps for extracting the stone, was perhaps the greatest; but neither this, nor any other advantage it can receive, can obviate the difficulties I have mentioned. We find accordingly, that, about the beginning of the 16th century, some time between the year 1500 and 1520, a new method of operating for the stone was proposed at Rome, by Johannes de Romanis, as we are afterwards informed by one of his pupils, Marianus, and whose name has been commonly given to it; this being termed the *methodus mariana*, or lithotomy by the greater apparatus, from the great number of instruments that at first were employed in it.

SECTION V.

Of Lithotomy by the Greater Apparatus.

BY this operation a passage is made into the bladder, by cutting into the urethra at the bulb; at which a variety of instruments were introduced, for the purpose of dilating the passage to such a size as might easily admit of the extraction of the stone.

For a considerable time after this operation was proposed, a number of inventions were brought forth, for the sole purpose of rendering the dilatation of the urethra and adjacent parts more easy. These it is unnecessary to enumerate, as an account of the operation, as it was last practised in its most improved state, will serve to communicate all that is necessary to be known concerning it.

The patient being secured, and placed upon a table in the manner to be described more particularly in Section VII. a grooved staff was then passed through the urethra into the bladder; the handle of the instrument being carried over the right groin, while its convex part was made to push out the urethra on the left side of the perinæum. In this position the staff was preserved by an assistant, who likewise suspended the scrotum; while the operator, with a scalpel in his right hand, made an incision from the very bottom of the scrotum to within a finger's breadth of the anus, carrying it along the left side of the perinæum, within a very little of the rapha.

The skin, cellular substance, and muscles, being thus divided, the urethra itself was now opened in its bulb, by cutting directly into the groove of the staff; and the incision was completed by carrying the knife along to the extremity of the urethra, at the commencement of the prostate gland.

Various instruments were at one period in use, termed dilators, and male and female conductors, for

the purpose of finishing the operation, by dilating such parts as were not cut ; and the timidity of some operators was such, that they dilated, stretched, or lacerated almost all that part of the urethra that lies between the bulb and prostate gland ; a degree of caution by no means necessary, and which, by the violence which this dilatation did to the parts, was sure to produce very distressful consequences. Other practitioners, however, performing the operation so far in the same manner, finished the other parts of it in a different way. They first introduced a blunt gorget into the bladder, by running its beak along the groove of the staff, and pushing it forward, so as to force a passage through the prostate gland ; and this being done, the forefinger of the left hand was pushed along the gorget, and with it the passage was further dilated, till the opening was supposed to be sufficiently large for the stone to pass through it.

The opening into the bladder being in this manner completed, the stone was extracted in the manner I shall hereafter point out, when treating of the lateral operation, in Section VII. by the use of different forceps adapted to the size of the parts ; and on extracting the stone, all those parts that were not cut in the previous steps of the operation, were of necessity greatly lacerated.

Although this operation was long practised, it is liable to many objections. Of these, the number of instruments used in it is mentioned as one : but, in the improved state of the operation, that I have described, this objection is entirely removed, no more instruments being used in it than are daily employed in the most simple method of performing the lateral operation ; namely, a scalpel, a gorget, and forceps for extracting the stone. But the material objections to which it is liable are, that by beginning the incision too near to the scrotum, much more of the urethra is cut than is necessary : by not dividing the prostate gland with the scalpel, the parts are so much

lacerated, first by the forcible introduction of the blunt gorget, and then by the extraction of the stone, as must be the cause of much irreparable mischief: and lastly, by the parts not being freely divided, we might frequently find it impossible to extract large stones by this operation, which, in the lateral method now practised, might pass with ease. In other respects, however, this operation possessed much merit, and it required only to be improved in a few circumstances, to become the real lateral operation of modern practitioners. These, however, it is unnecessary to enlarge upon here, as they will be afterwards particularly pointed out in the description to be given of the lateral operation.

After this operation had been practised for thirty or forty years, some of the inconveniencies that result from it suggested the idea of what was afterwards termed the high operation; an appellation which it derived from the bladder being cut into above the ossa pubis.

About the year 1561, Franco, a French surgeon of this name, published a treatise on herniæ;* and here we find the first account of the high operation. It was first suggested to Franco by accident; for having, as he informs us, met with a large stone in a child two years of age, which he could not possibly extract by the operation then practised in the perinæum, he was induced to open the bladder above the pubes: but although the stone was extracted, and the child recovered, Franco never performed the operation again; and he even advises it not to be done by others, from the great danger which he thinks will attend it.

The next account we find of it is by Rossset, in a publication on this and other subjects, published at Paris in the year 1590. But it does not appear that he ever performed the operation himself; nor was it

* *Traité très ample des Hernies, par Pierre Franco.*

any where much practised till some time after the commencement of the present century, when it was adopted and keenly patronised in London by Mr. Cheselden and Mr. Douglas.

During the twelve or fifteen years immediately subsequent to the year 1720, the high operation was frequently performed both in London, Edinburgh, and other parts of Europe; but the lateral operation, with the improvements upon it by Rau, being then more generally known, the superior advantages it was found to possess very quickly procured it a preference; and since this period the high operation has never been generally practised, either in this or any other country; but I shall now proceed to describe the method of doing it.

SECTION VI.

Of the High Operation for the Stone.

I HAVE already made it appear, that the fundus of the bladder, or that part of it lying highest in the pelvis, is covered with the peritonæum; so that at this part no opening, it is evident, can be made in it with safety, as the operator would not only incur the risk of wounding the intestines, but the urine would be apt to escape into the abdomen. It is the anterior part of the bladder, namely, that part of it that lies between the middle of it and its neck, that ought to be opened in this operation: but this part of the bladder is seldom sufficiently elevated, and as one common effect of the stone in the bladder is to induce a diminished or contracted state of it, this circumstance of itself is a very important objection to this operation; for unless the bladder can contain a large quantity, at least a pound and a half in an adult, it ought not to be attempted.

Various methods have been proposed for distending the bladder. Some have said that it may be done by throwing air into it with bellows; and others have advised a quantity of water to be injected immediately before the operation, and to retain it by forming a ligature on the penis. Both of these methods, however, are apt to do harm by distending the bladder too suddenly; and we are even told by some, that it has been burst by this kind of treatment. Means, therefore, of a more harmless nature should be attempted; and it may be done without running any risk of hurting the bladder, merely by the patient being accustomed, for a considerable time before the operation, to retain his urine as long as possible; and as soon as it is found that he can retain a sufficient quantity, by passing a ligature upon the penis ten or twelve hours before the operation, and causing him to drink plentifully of any diluent drink, we may be almost certain of producing an easy and sufficient degree of distention.

This being done, the patient must be laid upon a firm table, about three feet four inches in height; at the same time that his legs and arms should be secured, not with ligatures, but with the hands of assistants. In order to guard as much as possible against any injury being done to the bowels, the patient should be laid with his head considerably lower than his body, and his thighs and buttocks raised. By this situation, too, the stone, which would otherwise fall into the neck of the bladder, where it could not be very accessible, is brought more contiguous to the intended opening, and is thereby more easily laid hold of, either with forceps or the fingers.

The patient being thus properly secured, an incision is to be made with a round edged scalpel, directly upon one side of the linea alba, beginning about four inches above the ossa pubis, and ending at the symphysis of these bones: even the linea alba itself may

be cut with safety; but it is better to avoid it, as the incision is more easily made in soft parts than in tendons or ligaments. The skin and cellular substance being freely divided, the recti and pyramidales muscles come successively into view: in general, the incision may be carried on merely by separating these muscles from one another; but no harm could be done by some of their fibres being cut.

A sufficient opening of the external parts being in this manner obtained, the operator should now search with his fingers for the bladder, which he will commonly discover immediately above the pubes. With the fingers of his left hand he should now press back the peritonæum, with the intestines contained in it, and with the same scalpel with which he performed the preceding steps of the operation, he should penetrate the bladder itself in its most prominent part. This opening into the bladder should at once be made so large as to admit two of the fingers of the operator's left hand; which being introduced, the incision should be enlarged to the length of three inches, by running a probe pointed bistoury along one of the fingers, down towards one side of the neck of the bladder. The instant that the fingers are introduced into the bladder, the ligature upon the penis should be taken off, so that the water contained in it may be discharged by the urethra, otherwise the whole will be discharged by the wound, and part of it might lodge among the contiguous muscles.

The incision being in this manner completed, the operator ought to search with his fingers for the stone, and if possible, it should be extracted without the assistance of instruments: but if this does not succeed, forceps must, no doubt, be employed. One great advantage that we derive from this operation is, that as the extraction of the stone does not require much force, so it is here rarely known to break: but when this misfortune takes place, the pieces will be more easily removed with the fingers alone, than with any

of the scoops commonly employed. The stones being removed, the upper part of the wound in the teguments should be drawn together, either with strong adhesive plasters, or with the twisted future, care being taken to leave at least an inch and a half in the under part of it open, in order to discharge any urine that may be thrown out from the wound in the bladder into the contiguous parts. It might even be proper to keep the whole external incision open till the wound in the bladder is reunited; but as the bowels, supported now by the peritonæum only, would be apt to protrude at this opening, and as this would prove not only troublesome but highly dangerous, it ought by all means to be guarded against.

With this view, the bowels should be kept open with gentle laxatives, and the patient during the whole course of the cure should be kept with his head and upper part of the body low, and the pelvis elevated.

The parts injured in this operation are not any where nearly surrounded with bone; so that large stones can be extracted with more ease in this than in any other way: and as the wound in the bladder is made far from its neck, fistulous openings are not so apt to ensue from it as from incisions in the perinæum. These are two advantages that we derive from this operation; but the objections to it are various.

1. When the bladder does not admit of such distention as to be raised above the pubes, it is almost impossible to make an opening into it without dividing the peritonæum. From this much danger would undoubtedly ensue; air would find access to the whole surface of the alimentary canal; the bowels would protrude, and urine would escape into the cavity of the abdomen.

Many, indeed, assert, that no danger ensues from the protrusion of the bowels; that the wound heals with the same ease, and that the patients recover equally well as if this did not happen. No practitioner-

er, however, in these times, will give credit to this, and it is accordingly a very important objection to the high operation.

2. As the urine is apt to find access between the peritonæum and abdominal muscles, as well as between the bladder and pubes, troublesome sinuses are apt to form in the cellular substance of these parts, and as no vent can be made for the matter, they always terminate in much distress.

3. It has been observed, when the habit of body is not entirely good, that a cure cannot be obtained either of the wound in the bladder, or external teguments. This, it will be said, may be alleged as an objection to every important operation; but it has been completely established by observation, that degrees of disease in the constitution prove highly detrimental in the high operation for the stone, which in the usual method of operating in the perinæum give much less cause of alarm.

4. This operation is confined almost entirely to patients under thirty years of age: for although it was at one period frequently practised on older people, and although no particular reason can be given why it ought not to succeed in more advanced ages, yet we learn from almost every author who has written upon it, particularly from Middleton, Smith, Douglas, and Heister, that a very small proportion only recover of such as have passed their thirtieth year.

It is perhaps for one or other of these reasons that the high operation has fallen into disuse, and that it has not been much practised for a great length of time in almost any part of Europe. But although this method of operating is attended with hazard, and is frequently followed with distressful consequences, yet there is reason to think, that, in particular circumstances, it might be practised with advantage.

The most material objection, to the modern or lateral method of performing this operation, arises from the bruising of the soft parts against the contiguous

bones in the extraction of a large stone; which is so much the case, that we may consider the risk in that operation to be almost in proportion to the size of the stone. When a stone is small and easily extracted, the proportion of deaths in the lateral operation is very small: but whenever the stone is of such a size as to weigh seven, eight or ten ounces, it is perhaps one of the most dangerous operations to which a patient can submit. In different instances, too, the stone has been so large, that it could not be taken out by the lateral operation; nay, some cases are on record, in which it became necessary to perform the high operation, after the operator had failed in extracting the stone by the usual method of cutting in the perinæum.*

When, therefore, from the long continuance of the disease; from the sense of weight about the neck of the bladder; and particularly when from the touch by the finger in ano, we have reason to suspect the stone to be large, it ought to be an object of consideration, how far it may be proper to avoid the lateral, and in certain circumstances, to employ the high operation. The circumstances to which I allude, respect the age of the patient, the soundness of his constitution, and the possibility of distending the bladder so as to raise it above the brim of the pelvis. These circumstances are favourable where the stone is large; and when it is known to be so, the high operation, although less advantageous in the general run of calculous cases than the lateral method of cutting, may be practised with a greater probability of success than any other with which we are acquainted.

Having now said all that is necessary respecting the apparatus altus, we shall proceed to the consideration of what has usually been termed the lateral operation.

* We find that it happened to Heister. Vide Heister's Surgery, p. 2. Sect. V. Chap. CXLII.

SECTION VII.

Of the Lateral Operation.

IN the operation of lithotomy, as it was formerly practised by the great apparatus, the external incision was made in nearly the same part that it is now in the lateral operation; but the two methods of operating are materially different in every other circumstance.

The original invention of the lateral operation is due to a French ecclesiastic, commonly known by the name of Frere Jacques. This operator first appeared at Paris in the year 1697, when, by the successful event of a few cases, he was desired to operate upon a great number. But it soon appeared to practitioners of discernment, that the fame he had acquired would not probably be of long duration. For with a very imperfect knowledge of the anatomy of the parts concerned in the operation, a bad assortment of instruments, and a total neglect of his patients after the operation, it was scarcely possible that much success could result from his method. His manner of operating was as follows:

The patient being properly secured, either upon a table or on a bed, a common solid staff was introduced into the bladder by the urethra, and the handle being carried over the right groin, the convex part of it was made to elevate the teguments and other parts on the left side of the perinæum.

With a straight bistoury he now made an incision through the skin and cellular substance, beginning between the anus and tuberosity of the ischium, and proceeded upwards along the left side of the perinæum, at a small distance from the rapha, till it extended at least one half of the course of the perinæum. With the same knife he now went on along the direc-

tion of the staff, to divide the parts between the external incision and the bladder, which he also opened with the point of the same knife with which the other steps of the operation had been done. At this opening in the bladder he first introduced the index of his left hand, in order to discover the situation of the stone; and having withdrawn the staff, he laid hold of the stone with forceps, and performed the extraction in the usual manner. The patient was now carried to bed, and no farther attention was paid to him by the operator, who never applied any dressings, as he trusted the subsequent management of every case to the nurse or other attendants.

In consequence of this unpardonable neglect, and by frequently cutting parts in the course of the operation which he ought to have avoided, a great proportion of those on whom he operated died; no less, we are informed, than twenty-five of sixty.* Hence Jacques soon fell into disrepute; and although he afterwards made many improvements in his method of operating, particularly in using a grooved staff instead of a solid one, and in being more attentive to the subsequent management of his patients, yet his reputation in Paris never gained ground; nor do we find that his method was ever attended with much success, either in Holland, or in the various parts of Germany, where he afterwards practised.

For with so much inattention did he proceed, that although he professed to cut directly into the body of the bladder, without injuring either the urethra or prostate gland; yet in the dissection of such bodies as died of the operation, it was found, that in many the prostate gland was divided, together with the vesiculæ seminales. In some instances, the bladder was cut in two or three different parts; in others the rectum was divided; and it even frequently happened, that

* Vide Morand *Opusculæ de Chirurgie*, partie ii. p. 54.

the bladder was entirely separated from the urethra.* We need not wonder, therefore, that this practitioner, as well as his method of operating, soon fell into discredit. But although this was a consequence that necessarily ensued from the ill success that attended his practice; yet the world, we must admit, is much indebted to Jacques, for having laid the foundation of the lateral method of cutting for the stone, which, in its present improved state, is practised with so much success over all Europe.

Rau was the first who endeavoured to improve this operation of Frere Jacques, which he did by using a staff with a deep groove, by which he was enabled to continue the incision into the bladder with more certainty than can be done with a staff entirely solid. But Rau, afraid of wounding the prostate gland, introduced a refinement into his method of cutting, which, in the event, proved extremely hurtful, and was probably the cause of its being afterwards laid aside. For, instead of dividing the urethra and prostate gland, by which the extraction of the stone would have been made easy, he dissected with much caution by the side of the prostate, till the convex extremity of the staff was discovered in the bladder itself. At this part an incision was made into it, and the stone thereafter extracted, in the manner then practised for cutting with the great apparatus.

By this method of operating, the rectum and vesiculæ feminales were in great danger of being injured; the stone was extracted with difficulty; and from the depth of the incision, the urine did not pass easily off by the wound, so that troublesome sinuses frequently ensued.†

* For a particular account of Frere Jacques's method of operating, see Dr. Lister's Journey to Paris; the works of Dionis, Meri, Collet, Saviard, and Morand.

† Rau himself kept this method of operating as much concealed as possible. But an account of it was published after his death, by Albinus; who, by assisting frequently at his operations, became perfectly master of the manner of performing it. Vide Index suppellectilis anatomicæ, &c. Lug. Batavorum.

These inconveniencies prevented this operation of Rau from ever being generally received, and suggested to our countryman, the celebrated Cheselden, the lateral method of cutting as it is now, with a few alterations, very universally practised.

As this operation of Mr. Cheselden is described by many writers in surgery, it is not here necessary to enter into a detail of it : I shall now, therefore, proceed to describe the lateral operation in its present improved state.

That the patient may not find it necessary to go soon to stool after the operation, several stools should be procured by a purgative on the preceding day ; and with a view to discharge the contents of the rectum more entirely, an injection should be given a few hours before the operation is performed.

When the bladder is in a collapsed state, it is liable in this operation to be cut in different parts by the gorget ; the patient ought therefore to be desired to drink plentifully of some diluent liquor, and to retain his urine for several hours before being laid upon the table : in some, however, the irritation produced by the disease is in such a degree as entirely to prevent this voluntary retention of urine ; in which case the penis should be slightly compressed with a broad fillet for some hours before the operation ; and we lessen or remove the irritation by a large dose of opium.

These circumstances being adjusted, and the perinæum and parts about the anus being shaved, the patient is now to be laid upon a table for the operation. The most convenient height for this table is three feet two inches. It ought to be perfectly firm ; and, that there may be sufficient space for the patient, it should be about three feet eight inches long, and two feet and a half wide.

The patient should be completely and properly secured, and the following is perhaps the best method of doing it : let a noose be formed in the double of a piece of broad firm tape, five feet in length : the pa-

tient's wrists being passed through this noose, he should be desired to take a firm hold of the outside of the ankle of the same side, when, by different turns of the tape round the hand, ankle and foot, his hand is to be firmly secured in this position ; and this being done on one side, the hand and foot of the opposite side are to be firmly tied together in the same manner.

The operator should now introduce a grooved staff, of a size proportioned to the parts through which it is to pass. Different sizes of these staffs are represented in Plate LXIX ; the artist who makes them should round off the edges of the grooves, otherwise they are apt to injure the urethra ; and the extremity of the groove should be perfectly free and open, otherwise it is difficult to disengage the gorget after it has passed into the bladder. As the groove is only necessary in the convex part of the staff, and from that to its point, the handle of the instrument, down to the commencement of the convexity, should be entirely solid, so as to admit of the penis being pressed upon it without being hurt, either by the hand of the assistant, or by a piece of tape, which may be sometimes necessary, as I have already advised, for preventing the urine from being discharged.

I may here remark, that more attention should be given to the length of the staff than is commonly done. Staffs are in general too short ; so that when, in the course of the operation, the handle is pressed down upon the groin by the assistant, the point is very apt to slip entirely out of the bladder ; a circumstance to be guarded against with all possible attention, and it cannot with such certainty be done as by making the staff always of a sufficient length.

The stone being again distinctly felt, not only by the surgeon himself, but by his assistants, the patient must now be placed in that posture in which he is to be kept during the remainder of the operation. The table intended to be used should be perfectly level ; but, that the patient may lie upon it with as much ease

as possible, a pillow may be put under his head, and, that the pelvis may be higher than the abdomen, there should be at least two pillows under his buttocks, which should be made to project an inch or two over the end of the table.

A due elevation of the buttocks, is highly important, although seldom attended to by the operator ; indeed, the very reverse is often advised, the head and upper part of the body being generally kept higher than the pelvis. This, however, can arise from inattention only ; for we may by the least reflection be convinced, that the more erect the body is kept, the greater will be the pressure of the intestines upon the bladder ; and if, by this pressure, the fundus of the bladder is forced down upon its neck, the risk of its being wounded must be great indeed.

Of such patients as have died of this operation, I have, in different instances, found on dissection, that the bladder was wounded in three different parts : in its cervix, as is always the case when the gorget is of a proper length ; in its side considerably above the cervix ; and, again, in the fundus or upper part of it. Now, this can never happen, if the directions I have given are kept in view ; for when the bowels are prevented from falling upon the bladder, by the buttocks being raised above the rest of the body, and if, at the same time, the bladder is properly distended with urine, it must be altogether impossible, in the usual lateral operation, to injure it in an improper part. But if this precaution of having the bladder distended during the operation is neglected, at the same time that the bowels, by an elevated posture of the upper part of the body, are allowed to fall into the pelvis, the bladder must be so completely collapsed, and its fundus pushed so much down upon its neck, as must frequently be the cause of much unnecessary hazard.

Besides the cases to which I allude, in which the bladder was after death found to be wounded in different parts, we find a very candid acknowledgment

made by a celebrated lithotomist, of his being once so unfortunate in the lateral operation, that a considerable portion of the small guts passed immediately out at the wound.*

This would certainly have disconcerted many operators : but, fortunately for the patient, the operation was in this case completely finished ; the bowels were reduced and a perfect cure was obtained. Mr. Bromfield endeavours to account for this protrusion of the bowels in a different manner ; but I am much inclined to believe, that it happened from the pelvis not having been sufficiently raised above the rest of the body, and from the bladder having been in a collapsed state at the time the incision was made in it. For this author, it must be remarked, instead of ordering the bladder to be distended at the time of operating, desires expressly that it may be emptied immediately before the operation.†

Matters being adjusted in the manner I have advised, with respect to the patient, an assistant on each side is to secure his legs and arms : one must prevent him from moving the upper part of his body ; another must lay hold of the staff ; and a fifth is required to hand the necessary instruments to the operator.

The surgeon, after having again felt the stone with the staff, is now to make the head of it pass over the right groin of the patient, so that the convex part of it may be distinguished on the left side of the perinæum : in this position it may be exactly preserved by the assistant, who with his right hand should lay hold of the handle of the staff, while with his left he elevates and supports the scrotum.

The thighs of the patient being sufficiently separated by the assistants, and the surgeon being seated between the patient and the window, in such a manner that the light may fall directly upon the perinæum,

* Vide Mr. Bromfield's *Chirurgical Observations and Cases*, Volume II. page 264.

† Page 228, Vol. II.

an incision is now to be made with a common round edged scalpel through the skin and cellular substance, at least four inches in length in a full grown person, and so in proportion in smaller sized people ; beginning a little to the left side of the rapha, nearly an inch below the termination of the scrotum, and proceeding along the same side of the perinæum, till it runs at an equal distance between the tuberosity of the ischium and the anus, which last it ought to pass at least an inch.

As the success of the operation depends in a great measure on this part of it being properly performed, it ought at all times to be done with the utmost attention. From timidity or inattention, this external incision is commonly made too short : instead of four inches, I have often seen it, even in the largest adult, scarcely two. In consequence of this, the muscles, and other parts below, are not properly divided ; the operator has not freedom to prosecute the other steps of the operation ; and if the stone is large, the parts through which it has to pass must be much more bruised and lacerated than if they had been freely cut with the knife ; and as no harm can ensue from the external incision being free and ample, it ought in every instance to be so. Much hazard may ensue from the division of the teguments and muscles being small ; but none from their being largely laid open.

By this first stroke of the scalpel, the skin and cellular substance should be freely divided, so as to bring the subjacent muscles completely in view ; when, by a continuation of the incision, the erector penis, accelerator urinæ, transversalis perinæi and levator ani should be cut.*

* Soon after the first edition of this work was published, my friend Dr. Monro, in conversing on the lateral operation of lithotomy, observed, that I had desired muscles to be cut which might be avoided ; and knowing that Sharpe, Camper, and others who wrote upon this operation, soon after that important improvement was introduced, of cutting the prostate gland with the gorget of Hawkins, instead of the scalpel, were of opinion, that the extensive division that I have advised of these parts was unneces-

As no danger ensues therefore from a free division of these parts, and as a large opening not only facilitates the extraction of the stone, but admits of any blood vessel that is cut being easily secured with a ligature, which can never be done when the incision is small, it ought in every instance to be large. In general, the arteries with which these muscles are supplied are not so large as to render ligatures necessary;

fary, I shall here shortly mention the reasons that have made me differ from authorities of such respectability.

That this operation may be performed without dividing more muscles than the *transversalis perinaei* and *levator ani*, is well known; but it is not what may be done, but what ought to be done, that in all important operations demands our attention: on the point in question, my opinion has always been, that all those muscles should be cut that are apt to be bruised or torn in extracting the stone: now, this is so clearly the case with the *erector penis* and *accelerator urinae*, that few will doubt of the propriety of dividing them who have inspected them in patients dying after the extracting of large stones: wherever a stone has been large and difficult to extract, I have always found these muscles much confused, often lacerated, and commonly in a state of mortification. Whereas, when completely cut across, this does not so readily happen; the divided ends of the muscles retract; they are thereby saved from the violent pressure of the forceps and stone; and the operation is finished with much more ease than it otherwise possibly could be.

Having long observed this to be the case; knowing that no danger could ensue from dividing them, for it is daily done with impunity to a much greater extent in fistulous or sinuous ulcers of these parts, and finding upon trial that the more freely they were cut, the more successful the operation commonly proved, I have therefore long been in the practice of doing it: my operations indeed have proved successful nearly in proportion to the freedom with which these parts have been divided, at the same time that the wounds have healed more kindly than when small openings have been made.

Neither has this division of these parts any influence on the direction of the external cut, which ought to be in the line that I have mentioned, beginning nearly an inch below the termination of the scrotum, a very little to the left of the *rapha*, and proceeding obliquely along the same side of the *perinaeum*, till it runs at an equal distance between the tuberosity of the *ischium* and the anus.

If the skin and cellular substance have been freely divided, they retract so much, that all the muscles that I have mentioned may be cut with ease: this indeed is not often done; by which, stones even of no great bulk are extracted with difficulty to the operator, and with perfect torture to the patient; by which lives are often brought into hazard, and even lost, which otherwise might be saved.

I have insisted the more upon this, as I conceive it to be one of the most important points in this very interesting operation; one on which the success attending it must at all times in a great measure hinge; and particularly from my having witnessed more disastrous consequences from a timidity in regard to it, that is, from the muscles not being freely divided, than from all other failures on the part of the surgeon.

but whenever they prove to be so, and especially when the patient is weak and emaciated, the larger arteries should be immediately secured before the surgeon proceeds to the other steps of the operation.

In proceeding to finish the operation, surgeons not unfrequently open the urethra higher than it ought to be cut, and pass the knife into the substance of the bulb itself. But this adds greatly to the hazard of the operation: for, the blood vessels of the bulb are not only large, but sinuses are much more apt to form in it than in other parts of the penis, by which the cure of the wound is rendered much more tedious when this part is divided; and not being necessary, it ought always to be avoided. When, therefore, the incision of the muscles is finished, the operator ought to search for the staff with the index of his left hand; and having found it, he should push the point of his finger along the course of it till he passes the bulb, when, with the edge of his knife turned towards the groove of the staff, he should divide the membranous part of the urethra in its whole course, from the bulb to the prostate gland; and the finger being thus used as a director, while by means of it the rectum is completely guarded, this incision of the urethra may be made with entire safety. There is in general, indeed, such a quantity of cellular substance between the urethra and rectum, that in this part of the operation the gut cannot possibly be hurt, if the surgeon is not either very unsteady or inattentive: and by means of the precaution I have advised, of keeping the forefinger of the left hand always between the knife and the intestine, it may in this manner be in every instance very certainly avoided.

The incision of the urethra being finished, the prostate gland, which we readily discover with the finger at the bottom of the wound, is next to be divided. In the hands of an expert surgeon, the operation might be finished with the same safety with the scalpel as with any other instrument: for, by continuing

the incision of the urethra, and carrying on the scalpel so as to divide the prostate gland laterally, if the finger is still continued between the knife and the rectum, no risk could ensue from it : but as this part of the operation is performed entirely by feeling, without the assistance of the eyesight ; and as many operators are not so much accustomed to this, as, in such circumstances, to be sufficiently steady, the rectum might be often injured were the scalpel to be commonly employed for completing the operation.

This inconvenience, however, of wounding the rectum, may with certainty be avoided, by using a cutting director, or gorget, as it is termed, instead of a scalpel : this alteration of the gorget was first proposed by Mr. Hawkins of London : in Plate LXXI. fig. 4. a view is given of this ; and in the same Plate, and likewise in Plates LXX. LXXII. and LIX. and LX. I have delineated different improvements that have been proposed upon this instrument of Mr. Hawkins.

The gorget of Mr. Hawkins is contracted too much at the cutting part of it, by which it does not divide the prostate gland sufficiently. Were we to use a gorget much wider in the cutting part of it, the division of the prostate gland might indeed be made extensive enough ; but it is not done by the gorget in common use, so that the division of this gland is commonly too small, either for the extraction of a stone, or even for the introduction of the forceps, without much laceration ; a circumstance that in every instance should be guarded against.

The gorget in ordinary use, while it is too narrow in the cutting part of it, is too wide behind ; a form which the least reflection must shew to be not only unnecessary but hurtful ; for, after the division of the prostate gland, the only use of the gorget is to serve as a conductor to the forceps ; and as this purpose is answered equally well by a director that does not expand to near the extent of the gorget, it is obviously improper to have this instrument so wide as it is com-

monly made. But farther, the impropriety of this construction is still more evident, when we compare the size of the common gorget with the parts through which it has to pass : for it is obvious, that it must greatly injure the urethra ; the back part of the instrument being so wide and deep, as to render it impossible to pass it, without much laceration.

The cutting director, Plate LXX. fig. 2. as well as the gorget, Plate LXXI. fig. 2. will be found to possess all the advantages of the common gorget, without any of its inconveniencies : the cutting part of both expands more than that of the common gorget, so that they divide the prostate gland more freely ; and as the blunt part of them is much contracted, they do not lacerate the urethra on being pushed forward. To those who have never used these instruments, and who thereby may have a partiality for the common gorget, these instruments may perhaps appear not to be sufficiently wide for conducting the forceps : this, however, is not the case ; and it will soon be found, that they are not only more easily introduced than the common gorget, but that they answer equally well for conducting either the finger or forceps.

It has been objected to these instruments, that they will not make such a free division of the muscles as is done by the common gorget. This, however, proceeds from prejudice in favour of an instrument with which practitioners are as yet better acquainted, and which has indeed been deservedly much employed ; but it is thrown out without due reflection on its import. I have already endeavoured to inculcate the necessity of a free division of the teguments and muscles in this operation ; but whoever considers this point with attention, will see, that this ought to be done with the scalpel alone, and that it should not depend in any degree upon the gorget : all that should be left for the gorget or cutting director to do, is to divide the prostate gland with a small portion of the

neck of the bladder. Some practitioners, indeed, have recommended instruments for carrying the incision into the body of the bladder; but this is a very hazardous attempt, and not in any respect necessary: for as soon as the prostate gland and neck of the bladder are divided, the forceps are passed with ease; and the bladder itself is so easily dilated, that it readily yields to the passage of the stone, however large it may be. What I wish to have understood, is, that it is not the size of the wound in the bladder that renders the extraction of stones easy or difficult; and that it is on the previous incision of the muscles and prostate gland that this almost entirely depends.

The membranous part of the urethra being divided by the scalpel in the manner I have advised, the nail of the index of the left hand should be introduced into the groove of the staff, to serve as a conductor to the point or beak of the cutting director or gorget. The surgeon having no further occasion for the scalpel, must now lay it aside; and having passed the point of the director or gorget along his finger into the groove of the staff, he is now to take the handle of that instrument from the assistant, and having raised it from the groin of the patient in which it lay, he must with his left hand preserve it firm in this situation, while with his right he pushes on the cutting director or gorget till it has passed freely into the bladder; a point of the operation that he knows is accomplished when the urine is perceived to rush with freedom out at the wound. In executing the first part of the operation, the surgeon should be firmly seated; but in passing the gorget or director into the bladder, as likewise in extracting the stone, he should stand immediately before the patient, as in this posture these steps of it are more easily performed.

It is a point, I may remark, of the first importance in this operation, to raise the staff to a proper height before pushing on the gorget. The handle of the staff should form nearly, though not entirely, a right

angle with the body of the patient ; and if kept sufficiently firm in this position, the gorget or director may be pushed on with safety, as the beak of the instrument, if this direction of the staff is continued, can scarcely escape from the groove in which it runs. But if the elevation of the staff is either much more or less than this when the gorget is pushed forward, the point of the gorget, instead of passing into the bladder, must be forced out of the groove, and passing between the rectum and bladder, or between the bladder and pubes, it must here do a great deal of harm. I have known even expert surgeons, from an unpardonable degree of inattention, fall into this error with regard to the height of the staff. Younger practitioners, therefore, cannot be too much on their guard against it.

Even the greatest attention, however, to the elevation of the staff, will not of itself prove sufficient. The surgeon ought previously to see that the director or gorget is exactly fitted to the groove intended to receive it ; for if not properly adapted to each other, the gorget will not run easily, and may therefore be very readily pushed out of the groove of the staff.

With the view of rendering this part of the operation safe, different inventions have been proposed for fixing the beak of the gorget in the groove of the staff, so as to prevent it from getting out till it has passed into the bladder : but all of these gives some difficulty in passing the instrument ; and besides, they do not appear to be necessary, as no operator can possibly go wrong, but from gross misconduct or inattention.

As soon as the gorget has freely entered the bladder, the staff should be withdrawn ; and this being done, the next step in common practice is, to introduce the forceps immediately ; but as the stone may be frequently felt with the finger, and as no other method serves so effectually to discover its real situation, this precaution of introducing the finger into the

bladder ought never to be omitted. Little additional pain is given by the introduction of the finger, and if the operator is lucky enough to discover the stone, he is thereby instructed with much certainty of the best direction for the forceps.

The situation of the stone being in this manner discovered, or if, upon trial, it is found that the finger will not reach it, forceps, proportioned to the size of the patient, are to be passed into the bladder along with the gorget or director, while the latter is immediately thereafter to be withdrawn.

In an operation of such importance as this, the most trifling circumstance merits attention; for the more obvious and leading parts of it may be performed in a masterly manner, and yet the whole may fail from want of attention to the less important steps of it. Even the method of withdrawing the cutting director or gorget, is a matter that requires attention; much more, indeed, than it commonly meets with. After the forceps are introduced, the gorget should be slowly withdrawn in the exact direction by which it was entered; for if turned in any degree either to one side or another, it must necessarily make another incision, not only in the prostate gland, but in all the other parts through which it is made to pass; the impropriety of which is too obvious to require further animadversion.

If the stone has been previously discovered by the finger, it is commonly easily laid hold of with the forceps; but when the finger has not been able to reach it, it is in some instances with much difficulty met with. The forceps must necessarily be introduced shut, that is, with their blades as near to each other as their form admits of; for, with a view to prevent them from laying hold of the bladder, they should be so constructed as not to meet at any part except at their axis, by at least the tenth part of an inch. But as soon as they have entered the bladder, they should be gradually opened; and in this expanded state

should be easily moved about, with their handles sometimes depressed and sometimes elevated, till the stone is discovered, when it should as quickly as possible be laid hold of. It frequently, however, happens, even with expert surgeons, especially when the stone is small, that it is not readily discovered by the forceps. In such instances, we sometimes meet with it near to the fundus of the bladder; but it is most frequently found concealed in the under and back part of it, near to its neck, in that bag that I have mentioned as being formed by the natural pressure of the urine. When it is discovered in this situation, nothing will bring it so readily into contact with the forceps, as elevating this part of the bladder by introducing the finger into the rectum.

In general, straight forceps, such as are represented in Plate LXXV. fig. 1. and 2. are preferred to those that are much crooked, delineated in fig. 3. For they not only act with more power in extracting the stone, but serve equally well with the others for finding it. Every operator, however, should be provided with all the varieties of forceps now in ordinary use.

When the stone is difficult to discover, the surgeon is apt to allege that it proceeds from its being contained in some preternatural bag or cyst; and when laid hold of with the forceps, and an unusual degree of strength is required to extract it, this is commonly said to arise from the stone adhering to the coats of the bladder. That the weight of a stone will sometimes form a partial cavity for itself, by pressing that part of the bladder on which it lies into the neighbouring soft parts, there is no reason to doubt; and in some instances the bladder is found so much contracted round a stone, as to form almost two distinct bags. This, however, is rare; and the adhesion of stones to the bladder, I believe to be still less frequent, if it ever takes place. Stones have indeed been frequently found covered with the coagulable part of the blood, which in some instances becomes so firm and

tough, as to have the appearance of an organized membrane ; but we are perfectly unacquainted with any process of nature by which an adhesion can be produced between the bladder and a stone contained in it.

It cannot possibly happen by any communication of blood vessels betwixt the bladder and stone ; and it is equally improbable that it can be produced merely by agglutination ; for, by the intervention of the urine, with which the bladder is constantly moistened, such an effect must be with certainty prevented.

But it is not reasoning alone that militates against this opinion. For although such an occurrence has been frequently mentioned by authors, yet we do not meet with one authenticated instance of any firm adhesions betwixt the bladder and stones contained in it being discovered after death. I am therefore led to conclude, that this idea is entirely void of foundation ; and that it has probably arisen from the misconduct of operators, who, by making the external incision too small, or not dividing the muscles and prostate gland sufficiently, have experienced much difficulty in extracting a stone of even a moderate size, and who, to escape censure, have suggested the possibility of stones adhering to the internal coat of the bladder.

When the stone is laid hold of with the forceps, the operator, before he proceeds to extract it, ought to introduce his finger into the bladder, in order to discover whether it is properly fixed in the forceps or not. This in various instances proves useful, for on finding that a stone of considerable length is laid hold of in such a manner as to have its longest diameter made to press in a transverse direction with respect to the opening in the bladder, much pain and laceration, which would undoubtedly occur from extracting it in this direction, may be easily prevented, either by turning the stone with the point of the finger, when this can be done, or by letting it slip altogether out of the forceps, and again endeavouring to lay hold of it in a

more favourable position. When the operator is certain that this is properly done, he is then to extract the stone in a very slow and gradual manner. The forceps should be very firmly held in both hands, his right being applied towards the extremity of the handles, and his left near to their axis.

In common practice, if the stone does not come readily away, the force made use of is applied so as to dilate the parts equally in every direction. The stone is made to move not only upwards and downwards, but laterally; and, by some, even a rotatory motion is given to it. Nothing, however, can be more destructive than this to the parts through which the stone must pass, while at the same time it is evidently ill calculated for facilitating the extraction.

Instead of moving the stone in this manner, the pressure ought to be made almost entirely downwards; not directly from the symphysis of the pubes towards the anus, but in the course of the external wound, which ought, as I have already observed, to run at an equal distance between the anus and tuberosity of the ischium. As it will be admitted, that the force employed in extracting a stone must prove more useful when exerted upon parts that are soft and of a yielding nature, than when applied immediately upon a bone; so, whoever attentively considers the anatomy of the parts concerned in this operation, will see the propriety of the advice I have given. The opening into the pelvis is at this place so narrow, that a very slight examination must render it evident, that in extracting a stone, no advantage can be derived from lateral pressure. If, again, the stone is forced upwards, it must press against the bones of the pubes; for this direction nothing intervenes between these bones and it, except the urethra, and a small portion of cellular substance: and if directed towards the anus, it must press the rectum against the point of the coccyx, which will not only give much immediate distress, but must even add greatly to the hazard of the operation.

The rotatory motion which in this operation is sometimes given to a stone, unites all these disadvantages ; but by carrying the pressure downwards in the course of the wound, so as that it may fall between the anus and ischium, every inconvenience of this kind is avoided, and a more extensive dilatation is obtained than can be procured in any other direction.

By gradual pressure in this direction, the stone, if not uncommonly large, will for the most part be extracted at last ; but when, in the course of the extraction, the operator meets with much resistance to the stone, he should examine the state of the divided parts, and if any part of the muscles that ought to have been cut are still found entire, they should be immediately divided ; and the easiest method of doing it, is to secure the stone in the forceps with the left hand, while with a scalpel in the other, a complete division of the muscles is accomplished.

With a view to prevent the forceps from pressing so much upon the stone as might break it, some proposals have been made for rendering the degree of pressure steady and certain. Of these the best seems to be what is represented in Plate LXXVI. fig. 3. in which, as soon as the stone is laid hold of, it is preserved in the same position by means of a screw that passes from one of the handles of the forceps into the other. This, however, I consider as a very unnecessary addition to forceps ; for when a stone is small, no surgeon of experience will apply great force to extract it ; and when of a large size, it will be more for the patient's advantage that it should break than be extracted entire.

I have spoken already of the hazard arising from the extraction of large stones. It is indeed so considerable, as to warrant this conclusion, that, *cæteris paribus*, the hazard attending lithotomy may be considered as corresponding to the size of the stone to be extracted. In healthy subjects, when the stone is small, and the operation properly performed, scarcely

one in twenty die ; but although a few have recovered from whom stones of a large size have been taken, yet whenever the stone has exceeded seven or eight ounces in weight, not above one in ten recover.

This is accordingly a very important circumstance, and worthy of our most serious attention ; and although the breaking of a stone in the course of extraction, is in other respects disagreeable, yet, with a view to obviate the dreadful consequences of tearing out a large stone, when in the course of an operation it is found to be uncommonly large, and that it cannot be taken out but with much hazard to the patient, might it not be more eligible, either to endeavour to break it with the forceps already introduced, or to withdraw these, and to introduce others more fit for the purpose ? In Plate LXXVIII. fig. 1. is delineated forceps of this kind, originally invented by Andreas à Cruce, and since improved by Le Cat and others : by means of the long and strong teeth with which they are furnished, and especially by the intervention of the screw for compressing their handles, almost any stone may be broken into small pieces ; and this being effected, the different pieces fall to be extracted with common forceps.

In such circumstances, however, or when a stone has broken by accident in the course of an operation, the utmost care is necessary in order to extract every fragment ; for, if the smallest particle is left, if it be not afterwards washed off with the urine, it may prove highly detrimental, by serving as a nucleus for the formation of another stone. After all the larger pieces have been extracted with the forceps, a scoop represented in Plate LXXVIII. fig. 2. proves sometimes useful for taking out the smaller particles ; but for this last purpose, nothing answers so well as injecting large quantities of tepid water into the bladder, either with a syringe or bag and pipe. This may be done with entire safety, and it commonly answers the purpose for which it is employed.

When a stone is found to have a smooth polished surface, it is the common opinion that others must remain in the bladder, as this smoothness is supposed to arise from the friction of other stones ; while a rough unequal surface is supposed to denote the existence of one stone only. No dependence, however, should be placed on these circumstances ; for we daily meet with instances of a single stone with a smooth surface ; and of stones that are rough and unequal leaving more than one in the bladder. As soon, therefore, as one stone is extracted, the operator, instead of trusting to external appearances, should first search the wound with his finger, as far as it will reach, and then, either with common forceps, or with the thick curved instrument represented in Plate LXXII. fig. 1. which may be termed a searcher, and which answers the purpose better ; and as long as any stones are discovered, the forceps should be repeatedly introduced till the whole are taken out.

In the course of this operation, some blood vessels, as I have already observed, are unavoidably divided ; but when the incision is kept sufficiently low in the perinæum, and when therefore the bulb of the urethra is avoided, there is seldom much risk to be dreaded from any hemorrhagy that ensues. It sometimes, however, happens, that those branches of the internal iliac artery that supply the parts lying anterior to the prostate gland, are so considerable, as to pour out a good deal of blood : but as a free discharge during the operation is the best preventive of inflammation, a symptom more to be dreaded than any other arising from lithotomy, nothing in general should be done, except in very weak habits of body, to put a stop to the hemorrhagy till all the stones are extracted ; when, if it still continues, any artery that appears should be secured with a ligature ; and if the external incision has been made large in the manner I have advised, this part of the operation does not prove so difficult as is commonly imagined. In different instances, I

have passed a ligature upon an artery almost as deep as the prostate gland ; and when a large vessel has been cut, the advantage derived from this effectual method of securing it, is of itself a very important argument for making the external incision in every instance free and extensive.

When, however, the divided vessel cannot be secured with a ligature, we are then to endeavour to stop the hemorrhagy by pressure ; and for this purpose a firm roller introduced at the wound would commonly answer ; but in order to avoid any stop to the flow of urine, instead of a solid roller, a silver canula covered with soft linen may be employed. Of this instrument I have given a representation in Plate LXXVIII. fig. 3.

Notwithstanding, however, of every precaution, some of the deep seated arteries, divided in the operation, continue sometimes to pour out a great deal of blood, and which, instead of passing off by the wound, is, in some instances, collected in great quantities in the cavity of the bladder. As soon as this is perceived, means should be employed for removing the blood ; and the most effectual are, to extract as much of it as possible, by a proper use of a scoop, Plate LXXVIII. fig. 2. and afterwards by injecting warm water at the wound, to wash off the remainder. In this manner very large collections of blood may be removed ; and when, as has sometimes happened, means of this kind have not been employed, the coagulum has at last become so firm, and has filled the cavity of the bladder so much, as to prevent entirely all further deposition of urine. In this case the belly becomes pained and swelled ; fever takes place ; and death itself very commonly succeeds.

With a view to prevent this unfortunate issue with as much certainty as possible, every patient should, immediately after the operation, be laid in such a posture as may with most certainty tend to discharge any blood that may fall into the bladder. Instead of laying the head low, and the buttocks high, as is com-

monly done, the pelvis should be lower than the rest of the body ; by which the wound is kept in a depending posture, which serves to assist the discharge of any blood that the arteries may pour out. As soon as the flow of blood is stopped, the patient should be untied, and a piece of soft lint being inserted between the lips of the wound, the thighs should be laid together, in which position he should be carried to bed ; and an opiate being given, he should for some time be left entirely to the charge of an experienced nurse. No dressing answers so well as dry lint ; for as the urine is constantly passing off by the wound, and as the parts are thereby kept wet, which makes them apt to fret, a frequent renewal of dressings becomes necessary ; and nothing is either more easily applied or removed than a piece of dry lint.

When the stone has not been difficult to extract, the patient generally remains free from much pain ; and he frequently falls into rest, and sleeps during the first three or four hours after the operation : but when the stone is large, and much violence has been done to the parts in taking it out, severe pain in the under part of the belly often supervenes in the space of an hour or two from the operation ; and it commonly proves, when not speedily removed, to be one of the most alarming symptoms that takes place. When merely spasmodic, however, which in some instances appears to be the case, it is commonly soon removed by the use of warm fomentations to the belly, or by emollient anodyne injections thrown into the rectum.

When by the use of these remedies, the pain is found to abate, little or no anxiety need be entertained on account of it ; but when, instead of becoming less violent, it proceeds to increase, and especially when the belly becomes hard and tumefied, and the pulse full and quick, much danger is to be dreaded. As these symptoms almost constantly proceed from inflammation, blood should be taken in quantities proportioned to their violence ; emollient injections should be con-

tinued ; and if the local application of heat to the abdomen, either by warm flannels, or by warm water contained in a bladder, does not answer, the patient should be immediately put into a femicupium. In such circumstances, indeed, I have experienced more advantage from this than from any other remedy ; for it not only conveys the heat more directly and more fully to the parts affected, but a free discharge of urine by the wound is also more commonly procured by it than in any other manner, so that much relief is often obtained from it.

A due perseverance in these means, with a proper use of opiates, a low diet, and a free use of diluent drinks, will frequently remove very alarming symptoms. But, in some instances, all our efforts prove fruitless : the pain and tension of the abdomen continue to increase ; the wound, instead of putting on a florid, healthy appearance, remains sloughy and pale, which seldom fails to precede the most alarming symptoms ; the pulse becomes quick and feeble, and death closes the scene. But, when matters terminate happily, the wound by degrees becomes red and of a healthy aspect : the urine, in some instances, passes by the urethra from the first ; but in most cases it comes away by the wound for the first two or three weeks : the pain in the belly gradually abates ; and any symptoms of fever which prevailed at first, are in a short time entirely removed.

The period at which a complete cure of the wound is accomplished, is exceedingly various, and depends on the health of the patient : in some few cases of young healthy boys, I have known it completely cicatrised in less than three weeks ; but in others, not till the sixth, seventh, or eighth week. In some instances, again, although a great part of the sore may heal rapidly, yet a small opening will remain, at which the urine continues to be discharged, and, the edges becoming callous, a real fistula is produced, that cannot be cured but by another operation ; the manner of

performing which I shall presently have occasion to mention. Indeed the prevention of fistulous openings depends much on proper attention in dressing the wound. If care is taken to introduce the lint sufficiently within the lips of the wound, till granulations fill it up at bottom, there will seldom be any risk of fistulous fores. The wound ought not, however, to be crammed, either with lint or any other dressing; for in this case the edges must either inflame, or acquire a morbid hardness. In other respects, the treatment should be nearly such as is known to answer in similar wounds in other parts. It is proper, however, to observe, that nothing removes that excoriation of the buttocks with such certainty, which sometimes proves troublesome after this operation, from their being kept constantly wet with the urine, as frequent bathing with brandy or lime water.

Where the constitution is enfeebled, incontinence of urine is apt to succeed to this operation; for the removal of which nothing proves successful till a recovery of strength has taken place. A light invigorating diet, together with the use of the cold bath and Peruvian bark, are therefore our principal remedies. But, in order to obviate the immediate disagreeable effect of a constant discharge of urine, different instruments have been invented. Some of these have in view the compression of the penis, in order to prevent the urine from being discharged; and others, while they are so formed as to be concealed within the patient's breeches, are meant to serve as receptacles for the urine on its passing from the urethra.

In Plate LXXVII. fig. 1. is represented the most convenient form of the first of these; and in fig. 2. of the same Plate, as well as in Plate LV. fig. 2. are delineated receivers, which by experience have been found to answer the purpose of the latter both with ease and certainty; and they may also be used in all cases of incontinence of urine, whether arising from this operation or any other cause.

While from the shortness of the urethra in women, they are less liable to the stone than men, the operation of lithotomy with respect to them, is, on the same account, much more simple, and of course more easily performed, and accompanied with less hazard. It cannot be done by cutting from the perinæum, in the same manner as in male subjects; for, as the urethra and bladder lie immediately above the vagina, any opening made into them from the perinæum, would pass through the vagina, so as to wound it both above and below. There is no necessity, however, for hurting the vagina, as the urethra may be divided from one end to the other, without any risk of touching it.

The patient being placed upon a table, and secured in the manner I have already advised for male subjects, a grooved staff, such as is represented in Plate LXX. fig. 5. is to be introduced into the bladder, by passing it along the urethra, which lies between the nymphæ, immediately below the clitoris; and the operator, keeping the staff firm with his left hand, must with his right introduce the beak of the cutting director, fig. 1. of the same Plate, or of the gorget, fig. 2. Plate LXXI. into the groove, and then push it easily along till it has fairly entered the bladder. The staff is now to be withdrawn, when the operator, as in male subjects, should introduce his finger along the director; and having discovered a stone, should proceed to extract it in the manner I have already advised.

By the old method of cutting in females, namely, with the greater apparatus, no incision was made into the urethra, but different instruments were used for dilating it; and this being done, the forceps were employed for extracting the stone. In this manner, however, the parts were much lacerated; the patient suffered a great deal of unnecessary pain, and the bladder was commonly deprived of all power of retention. I have therefore no hesitation in giving a preference to the method of operating that I have pointed out, in

which the urethra is cut through its whole length, instead of being lacerated or torn.

As the bladder in females lies immediately above, and quite contiguous to, the vagina, it has been proposed, that, instead of laying open the urethra, as I have advised, an opening should be made directly into the bladder from the vagina, at which the forceps are to be introduced for extracting the stone. One case of this kind is recorded by Buffiere;* and, more lately, other three are related by the late Mr. Gooch, in which this method of extraction was successfully employed.† It has never, however, been generally adopted; and as various objections occur to it, I do not suppose that it will ever be frequently practised.

By cutting into the bladder through the vagina, parts are injured, which by the other method are avoided: the stone, when it does not lie directly upon the vagina, is with difficulty laid hold of; it cannot be so easily extracted as when drawn along the course of the urethra; fistulous openings must probably occur more frequently after this method of operating than after the other; and if the woman should afterwards become pregnant, the cicatrix formed in the vagina would produce pain, obstruction, and perhaps laceration in the time of delivery.

One great advantage derived from the lateral operation, in its present improved state, both in males and females, is, that no laceration takes place if the stone be not remarkably large; in which case, no precaution can altogether prevent it: but, in a great proportion of cases, if the parts are freely divided in the manner I have advised, all the risk attending laceration, and which I have endeavoured to point out as the most hazardous part of this operation, is avoided with certainty.

* Philosophical Transactions for the year 1669, p. 106.

† Vide Cases and Remarks in Surgery, volume ii. p. 182, by Benjamin Gooch.

I have thus described the various means which hitherto have been employed by practitioners, for extracting stones from the bladder ; and from what has been said, it appears, that the lateral operation is, in ordinary cases, greatly preferable to every other. It stands indeed so eminently superior to the others for general use, that it does not appear necessary to draw any farther comparison between them ; but, as I have already observed, particular cases sometimes occur, in which the high operation may with propriety be employed instead of it : I have already in strong terms pointed out the risk of extracting a large stone by the lateral operation ; and I have shown, that stones of any magnitude that the bladder can contain, may be taken out by the high operation. When, therefore, it is with tolerable certainty known, that a stone is uncommonly large, and when the high operation is in other respects admissible, it ought certainly in every such instance to be preferred : for although where stones are large it may be better to break them into small pieces in the manner I have advised, than to lacerate the parts by taking them out entire ; yet the practice is only proper when the operator unexpectedly meets with a large stone after the bladder has been cut into ; so that wherever it is previously known that a stone is large, much advantage may be derived from a judicious choice, on the part of the operator, of his method of operating.

In the directions that I have given for performing the lateral operation, the dictates of experience are strictly adhered to, and I have recommended nothing that is not either at present very generally adopted, or that I have not myself put in practice.

Many proposals have been made by individuals for the improvement of the operation of lithotomy, particularly of the lateral method of performing it ; but a minute detail of all that has been suggested upon the subject, is incompatible with the nature of this

work; nor could it serve any purpose, but to bring into view some particular modes of practice, which were either never generally followed, or which, if adopted, have fallen again into disuse.

The most remarkable of these proposed improvements of the lateral operation, are those of three French surgeons, Monsieur Foubert, Monsieur Thomas, and Frère Cosme. The two first, invented instruments for penetrating the body of the bladder, without wounding the urethra. The bladder being distended with urine, and an incision made through the skin and cellular substance, a cutting instrument of a particular construction is then pushed past the urethra into the side of the bladder; and an opening being made of a sufficient size, the stone is extracted in the usual manner. One material advantage expected from this is, that by the urethra and prostate gland being avoided, that inability to retain the urine, and other troublesome consequences, which sometimes ensue from injuries done to these parts, are not so apt to occur when the body of the bladder alone is wounded. But, independent of other objections to which this method of operating is liable, the wound in the bladder being sure to recede from the wound in the teguments as soon as all the water contained in it is discharged, will probably prevent it from being ever adopted; for the urine, not finding a free passage by the wound, must pass into the contiguous parts, where it must always excite very distressful consequences.

So that although this method of cutting directly into the neck or body of the bladder, is at first view, extremely plausible, yet the least reflection on the consequences that it would excite, must at once bring conviction of the risk that would result from it.

The operation of Frère Cosme is, in effect, the same with the lateral operation, as it is now commonly practised. The parts that are cut in it are exactly the same, only they are divided in a different manner. After the staff is laid bare in the usual manner, the

beak of the instrument, fig. 1. Plate LXXVI. is introduced into the groove; and being pushed forward till it reaches the bladder, the spring E is then pressed down, so as to raise the knife from its sheath, when the operation is finished by withdrawing the instrument in such a direction as may divide the neck of the bladder and prostate gland, in the same manner as is done by the common gorget: after this, the other steps of the operation are to be completed, in the manner directed above with forceps.

Most of the other deviations from the established mode of practice, hitherto proposed by surgeons, consist, either in some improvements of the cutting gorget of Mr. Hawkins, or in a preference which some practitioners still continue to give to the knife. I have already observed, that Mr. Hawkins' gorget does not spread sufficiently at the cutting part of it, and that it is wider and deeper behind than it ought to be, by which it is liable to tear and otherwise injure the urethra more than is necessary. This inconvenience, however, is removed by the cutting director that I have ventured to recommend, as delineated in Plate LXX. and in a great degree by the gorget, fig. 1. and 2. Plate LXXI.

In regard to the preference given by some to the scalpel, not only to the director, but to the cutting gorget, I have only to observe, that an expert surgeon of steadiness, and possessing a minute knowledge of the anatomy of the parts, may with ease and safety perform the operation with the knife alone; but I must also remark, that, when the scalpel only is employed, the danger of wounding the rectum would in common practice be very great, so that the gorget or cutting director, by either of which the gut is completely defended, ought to be commonly preferred.

In the course of this section, I have endeavoured to deliver all that is worth recording of modern practice in the operation of lithotomy: I am not conscious of

having omitted any improvements of importance ; and I hope it will appear that I have proposed some that are not generally known, or which, if known, are not commonly practised.

The operation of lithotomy being one of the most important in the department of surgery, I have been induced to extend this section to a great length : it may therefore prove acceptable, to students especially, to have such circumstances enumerated in a more concise manner, as particularly merit their attention.

1. I have already in strong terms pointed out the propriety of an absolute certainty being attained, of a stone existing in the bladder, before the operation of lithotomy is proposed : and I have endeavoured to show, that no symptoms, however strongly marked, afford sufficient evidence of the presence of calculus ; the operation of sounding, or touching the stone with a staff, being the only certain means we have of judging of its existence.

2. Before proceeding to the operation, a considerable quantity of urine should be allowed to collect in the bladder ; the rectum should be emptied by an injection, and the buttocks should be raised above the rest of the body : the external incision should be more extensive than is commonly advised. In full grown adults, instead of the usual length of an inch and half, or two inches, it should be at least three inches and a half long ; care being taken to commence the cut at the inferior edge of the pubes, and to continue it in an oblique direction, till it has passed the anus, at an equal distance between the end of the rectum and the tuberosity of the ischium.

3. As the chief resistance to the extraction of the stone, proceeds most commonly from the muscles covering the urethra, these ought to be freely divided : no danger can ensue from this, and much advantage is derived from it.

4. But, although a free division of the muscles is of much importance, there is no necessity for cutting

so much of the urethra as is commonly done : it does not facilitate the extraction of the stone, and it makes the operation more hazardous than when the membranous part of it only is divided. The incision being carried through the teguments and muscles, so as to leave the staff covered by the urethra only, the operator should insert the index and middle finger of his left hand into the bottom of the wound, by which means the rectum is completely protected ; and this being done, an opening should be made in the urethra with the point of the scalpel, very near to the prostate gland, from whence the incision should be extended upwards to the bulb, but no farther. This, I may remark, should be done by one stroke of the knife, and not by repeated incisions, as is commonly done ; for by this means a rugged unequal wound is produced. In the first part of the operation, the edge of the knife should be applied in such a manner as to cut from above downwards, as in this manner the incision is accomplished both with ease and safety ; but in dividing the urethra, the back of the knife ought to be turned down, while the edge of it penetrates the urethra, and runs along the sulcus of the staff. In this manner we cannot possibly hurt the rectum ; which is too frequently done in the usual method of performing this part of the operation.

5. We have now to divide the prostate gland, with a small portion of the neck of the bladder. This, I have observed, may be done with ease and safety, with the scalpel alone, by a good anatomist, accustomed to operate and whose hand is perfectly steady ; but as the prostate gland must be divided in such a direction as to avoid the rectum, with which it is connected behind, and likewise the excretory ducts of the vesiculæ seminales which terminate here, much accuracy is required to get it accomplished, and it can only be done with safety to these parts by a lateral cut through this gland. A very small variation in the

direction of the scalpel, might be productive of much danger ; and few practitioners being possessed of such equal steadiness as the certain prevention of this requires, a knife constructed in such a manner as to protect the rectum, at the same time that it divides the prostate gland properly, ought certainly to be preferred. The gorget of Mr. Hawkins is possessed of all these advantages ; but I have likewise shown, that it is attended with some disadvantages. These, however, are obviated by the cutting director that I have described, as well as by the gorget, Plate LXXI. fig. 1. and 2. which make a more clean and ample cut than the common gorget, at the same time that they do not tear the urethra, as is done by the gorget of Mr. Hawkins, from its expanding too much behind.

6. After the stone is laid hold of with the forceps, it should be extracted slowly ; not by a rotatory motion, or by pressure applied equally in all directions ; but by endeavouring to stretch the parts along the course of the wound, in a line directly between the anus and tuberosity of the ischium. Moderate lateral pressure may likewise have some influence ; but no force should ever be applied towards the upper part of the wound ; for nothing can be gained by doing so, and it must always do harm, by pressing the urethra against the pubes. When, in the course of extraction, it is found, that the passage of the stone is impeded by some of the muscles not being freely divided, this ought still to be done, by the operator keeping the stone firm in the forceps with one hand, while with a scalpel in the other, he cuts what is necessary ; or, the forceps may be held by an assistant, while this additional cut is going on.

7. The stone being extracted, soft dressings should be applied to the wound ; and the patient should be laid in bed, with his head and upper part of his body raised higher than the pelvis, so that any blood poured out from the wound, may be freely discharged, in-

stead of lodging in the bladder, which otherwise it might do.

Having thus enumerated such points in this operation as particularly merit attention, I shall now proceed to consider the operation of nephrotomy.

SECTION VIII.

Of Nephrotomy.

WHEN stones are impacted in the kidneys, so that they cannot pass off with the urine, they give rise to a train of very distressful symptoms, which at last almost constantly terminate in the death of the patient.

The severity of the pain is frequently indeed so great, as to have induced practitioners to suggest an operation for extracting the stones. This consists in a cut made through the common teguments and muscles, immediately above the kidney, with an opening into the kidney itself, of a sufficient size to afford a free passage for a stone of an ordinary size.

But we are to remember, that, however marked the symptoms of stone in the kidney may appear to be, that it is impossible to judge of it with precision. We know that stone in the kidney occasions pain in the region of the kidney, together with sickness and vomiting, and a discharge of urine, sometimes mixed with blood, at other times with mucus, and in some instances with purulent matter. We also know, however, that the same symptoms are not unfrequently induced by other causes, particularly by inflammation and consequent suppuration of the kidney. Many instances, indeed, have occurred of the most violent nephritic symptoms subsisting for a great length of time, where stones were suspected as the cause; but where the kidney has been found, on dissection, to be completely

suppurated, and as it were entirely dissolved, a quantity of purulent matter being all that it contained ; several cases of which have fallen within my own observation.

Even in calculus of the bladder, a disease less ambiguous than nephritis calculosa, the symptoms are never so distinct and characteristic as to render the operation of lithotomy advisable, if a stone be not discovered by the sound. But in diseases of the kidney suspected to proceed from stone, we are deprived of this means of distinction ; so that it might not unfrequently happen, that, after laying the kidney open, no stone would be found. This is, therefore, a very important objection to the operation in question.

But it is to be farther observed, that the kidneys lie at a great depth : although not entirely covered by the inferior false ribs, yet that these ribs project so much over them, as to stand much in the way of an operation ; and that, in corpulent people, the kidneys are scarcely accessible.

Hence, it is impossible to make an opening into the kidney with so much accuracy and precision, as the near contiguity of the neighbouring large blood vessels would require ; and whoever attempts the operation of nephrotomy, even on the dead body, will find it difficult, or perhaps impossible, to cut into the pelvis of the kidney, without opening some of the large blood vessels that belong to it : the great and immediate danger from such an occurrence, is too obvious to require to be farther mentioned.

When, indeed, the inflammation induced by a stone in the kidney, terminates in an abscess, and when the matter thus collected forms a tumor in which a fluctuation is distinguished, little or no danger can ensue from laying it open : and in such an event, the stone that produced the tumor will either be discharged along with the matter ; or it may, if it can be laid hold of, be afterwards taken out with safety.

The stone being thus taken out, the opening through which it passed, if the patient recovers, will either heal by the usual means employed for abscesses in other parts ; or the most unfavourable termination that can probably happen, will be a fistulous fore, through which a mixture of pus and urine will continue to be discharged.

Upon the whole, we may therefore conclude, that when not directed by the appearance of a tumor to the part that ought to be opened, the uncertainty of the ground upon which we proceed when we undertake this operation ; the difficulty of performing it ; and the very imminent danger that attends it, will more than counterbalance any advantage that can be derived from it ; so that the operation of nephrotomy will never probably be received into general practice, however much it may be recommended by some, who, in order to raise a reputation which they might not otherwise obtain, will sometimes step forward and propose with confidence what no practitioner of character would think right to attempt.*

SECTION IX.

Of Stones in the Urethra.

PATIENTS liable to calculous complaints frequently pass small stones with their urine. When these stones are smooth and not very large, they usually come off with little difficulty ; and in some cases stones even of a considerable size are passed without exciting much pain. But when an angular or rough

* For further information on the subject of nephrotomy, see Rossetus de Partu Cæsareo, cap. vii. sect. 4. Philosophical Transactions for the year 1696. Schenkii Observat. Med. lib. iii. Juncker's Conspect. Chirurg. tab. 93. Edinburgh Medical Essays. Mémoires de l'Académie Royale de Chirurgie de Paris. And Mery's Observations sur la Manière de Tailler.

stone is pushed into the urethra, if not so small as to pass off with the first flow of urine, it never fails to create a great deal of distress.

Pain is the first symptom produced by a stone lodged in the urethra ; and to this succeeds inflammation, tumefaction of the parts, and always a partial and frequently a total suppression of urine. In some instances, when a stone in this situation is long neglected, this suppression and consequent tumefaction terminate in a rupture of the urethra ; in consequence of which, the urine escapes into the contiguous cellular substance, and very troublesome swellings arise not only in the body of the penis, but frequently in the scrotum, and through the whole course of the perinæum.

The treatment suited to such tumors will be pointed out when we come to treat of fistulous sores in these parts ; so that I shall now only relate the easiest and most effectual means of extracting stones from the urethra.

When a stone has been long fixed at one particular part without yielding in any degree, and when the pain and inflammation that it excites are considerable, it ought to be cut out in the manner I shall hereafter advise ; but on first passing down from the bladder to the urethra, we frequently succeed by more gentle means.

Whether or not the urethra itself is possessed of any contractile power, is a point not to be easily ascertained ; but the muscles with which it is immediately connected, are, in common with other muscular parts, subject to the influence of stimuli ; and as nothing with which we are acquainted, can be supposed to give a more powerful stimulus to a sensible part than the irritation of a rough or angular stone, so we may fairly conclude, that when once a stone is impacted in the urethra, its further passage along that canal will be impeded by a spasmodic contraction of the contiguous muscles. One very important indication, therefore, in the treatment of this malady, is, the removal of

spasm ; and when we keep this idea in view, and continue to persist in the use of proper remedies, we seldom fail to bring off such stones as have been lodged in the urethra, without the aid of any chirurgical operation. But, instead of the application of means calculated for the removal of spasm, the ordinary practice of surgeons is the direct reverse, and is therefore apt to produce a very opposite effect.

An attempt is commonly made to push the stone forward at once with the fingers. It is obvious, however, that until the spasm by which the obstruction is partly produced is removed, every trial of this kind will rather tend to increase the complaint. For this reason, therefore, no pressure should be employed till the most effectual means have been used for removing the spasm produced by the stone. With this view, the patient, if he is plethoric, ought to lose a considerable quantity of blood by the lancet ; or, if he is thin and emaciated, a proportional quantity should be discharged by leeches, directly from the pained part. A quantity of warm oil should be repeatedly injected into the urethra, in order to lubricate the passage. The patient should be immersed in a warm bath ; and a full dose of laudanum should be given about an hour before going into the bath.

Together with these remedies, a plentiful use of diuretics, and diluent drinks, is commonly prescribed ; but, instead of proving useful, they almost constantly do harm. For, when the urine rushes out with violence, if it does not carry the stone freely out of the urethra, it tends to fix it more firmly than before ; and the pain thus produced, will always increase the inflammation, tension and spasm of the parts affected : so that whatever has much effect in increasing the quantity of urine, should be carefully avoided.

A proper quantity of blood having been discharged ; the patient having remained for a sufficient length of time in the warm bath ; and the opiate having begun to operate ; the parts will thus be as completely

relaxed as possible ; and this is the period when some attempt should be made for extracting the stone. Various instruments have been contrived for this purpose, particularly long small pliers or forceps, concealed in a canula of a size corresponding to that of the urethra ; but as none of these have ever proved useful, and as they often do much harm, by tending to increase the irritation in the urethra, I do not think it necessary to delineate any of them.

Instead of using these instruments, the surgeon should at first endeavour by gentle pressure to push the stone forward along the urethra, and by continuing to move it easily in different directions, and persevering for a considerable time, we often succeed in bringing it off, when otherwise it must have been cut out.

It frequently happens, however, that stones of such a size and figure get into the urethra, as cannot by any means be made to pass off. When a stone, thus fixed in the passage, is of such a form as to admit of the urine being discharged, a patient, rather than submit to an operation, will sometimes allow it to remain ; by which the stone, in a short time, commonly obtains an increase of size by a deposition of earthy matter from the urine : of this I have met with various instances, in which the stones became very large, and in which the urethra was so much dilated as to form an extensive pouch or cavity corresponding to the size and figure of the stone. But when the stone, instead of allowing any of the urine to pass, fills up the urethra entirely, it becomes necessary to remove it by an operation, as soon as the means that I have advised have been found to prove of no avail.

This operation consists in cutting directly upon the stone, and extracting it either with a scoop, or with small forceps ; but the methods of effecting this ought to vary according to the part of the urethra in which the stone is fixed. When a stone is situated near to the beginning of the urethra, and contiguous to the bladder, it has been advised to push it again into the

bladder by means of a staff: but as it might there probably acquire a larger size, and would consequently render the patient liable to all the distress and hazard arising from a stone in the bladder, this is a practice by no means to be admitted, as the stone may be extracted with much more ease from any part of the urethra, and with much less hazard to the patient, than is always incurred by the more formidable operation of cutting into the bladder.

When, therefore, an operation is necessary for extracting a stone fixed in the urethra near the neck of the bladder, the method of performing it is this:

The patient should be laid upon a table, and secured in the manner I have directed for lithotomy: and an assistant suspending the scrotum and penis, the surgeon, after oiling the first and second fingers of his left hand, should introduce them into the anus, and by means of them ought to press firmly upon the parts immediately behind the stone; which will not only enable him to lay it bare with more ease, but will be the surest method of preventing it from being pushed into the bladder by the necessary pressure of the knife. This being done, an incision should be made through the common teguments and urethra, so as to lay the stone completely bare; which may now be either turned out by a due degree of pressure applied with the fingers in the rectum; or, if this be not sufficient, it may be taken out either with a scoop, or with small forceps.

The after treatment is the same here as I have advised in the operation of lithotomy.

When, again, a stone has passed farther on in the urethra, in order to extract it the skin should be drawn as much as possible past it, either in a backward or forward direction; and the stone being now secured in its situation by pressure, a longitudinal cut is to be made upon it, directly through the skin, cellular substance, and urethra, of a sufficient size to admit of its being extracted, either with the scoop or forceps. The

edges of the wound are now to be completely cleared of fabulous particles, and the skin allowed to regain its natural situation ; by which means, if the operation has been properly done, the wound in the urethra will be entirely covered with skin that has not been injured ; a circumstance that tends to render the operation much less formidable than it otherwise would be ; for the wound in the urethra is thus so well protected, that it commonly heals by the first intention.

It sometimes indeed happens, when the operation is done in this manner, that in voiding urine, part of it escapes at the wound, and insinuates into the contiguous cellular substance. This, however, is a rare occurrence, and the inconveniencies that arise from it are easily obviated, by laying open any collection of urine that takes place during the cure.

When a stone fixes near to the point of the yard, in that part of the urethra running through the glans ; if it is so near as to be seen, it may frequently be taken out with small dissecting forceps : and in order to facilitate the extraction, when it cannot be otherwise done, the end of the urethra may be dilated with the point of a bistoury : but when this fails of success, an incision must be made upon the stone in the manner I have advised where the urethra is covered with skin. Soft dressings should be applied to the wound ; and when the cure is nearly completed, a hollow bougie, a short silver tube, or a catheter of elastic gum, should be passed into the urethra, in order to preserve it of a proper size.

The most perplexing situation in which a stone can be fixed in the urethra, is just behind the scrotum ; for if the stone is either forced into the scrotum, or if it becomes necessary to make an opening into it with a scalpel, the urine is apt to collect in it, from which a great deal of distress never fails to ensue.

In order, therefore, to obviate this inconvenience, as soon as a stone is discovered in this situation, we

should endeavour, with all possible attention, either to get it carried farther along the urethra, or, if this cannot be done, to push it back into the perinæum with a staff: but when this is found to be impracticable, and that the stone must be extracted, an incision should be made in the urethra, by beginning the cut at the under part of the scrotum, immediately to one side of the septum, and proceeding upwards till the stone is distinctly felt, when it must be laid bare and taken out in the manner I have already advised.

By making the incision from below upwards, any urine that escapes from the urethra finds a free passage; and if the opening is sufficiently large, the stone may in this manner be extracted easily: during the operation, the testes should be as much protected as possible: and on the stone being removed, the dressings should be applied in such a manner, that the sore may heal from the bottom; for this being neglected, and the teguments allowed to heal before every vacancy is filled up, purulent matter, and perhaps urine, will very probably collect, and may thus give rise to troublesome sinuses.

When urine continues to be discharged for any length of time at a preternatural opening of the urethra, whether the consequence of the operation of lithotomy or of any other cause, if the calculous diathesis prevails, stones of a large size will frequently form in the cellular substance contiguous to the opening. I have met with several instances of this: in some the stones were small, and easily taken out; but in others, where they spread and occupied a considerable portion of the cellular membrane, they were very difficult to remove.* The treatment here consists solely in making a free incision along the course of the calculous conerctions; in turning them out, either with a

* A very remarkable case of this nature is recorded by Gooch. See Cases and Practical Remarks in Surgery, vol. ii. p. 174, by Benjamin Gooch.

scoop or small forceps; and in dressing the wound properly, so as to induce a firm adhesion of the parts beneath, before the teguments are permitted to heal.

In females, the urethra is so short, and dilates so readily, that small stones seldom stop in it: they are most commonly carried off by the flow of urine that brings them into it; but when they happen to fix in it, they are easily turned out, merely by insinuating the end of a blunt probe behind them, and then pulling them forward: or, when this does not succeed, it may always be done with safety, by laying open the extremity of the urethra with a scalpel, so far as to admit of the introduction of small forceps.

CHAPTER XXX.

OF INCONTINENCE OF URINE.

INCONTINENCE of urine may arise from various causes; but being frequently connected with calculous complaints, and in some instances the consequence of the operation of lithotomy, I am hence induced to speak of it here.

1. It may arise from irritation about the neck of the bladder, produced by the friction of stones contained in it. Thus we know, that inability to retain urine is a frequent symptom of stone in the bladder; and we cannot suppose it to proceed from any other cause than the constant stimulus communicated by the stone to the coats of the bladder. For, were it always produced, as has been supposed, by a total loss of power in the sphincter vesicæ, the disease would seldom or never admit of a cure. But we know well, that incontinence of urine, depending upon stone in the bladder, is often removed entirely by the operation of lithotomy: and we likewise know, that it is often much relieved, even when the stone remains in the bladder, by the use of those remedies that most effectually remove irritability; particularly by a plentiful use of mucilaginous drinks, and a free use of opiates. By a continued use of these remedies, indeed, this variety of the disease is commonly removed with more certainty than by any other means, extraction of the stone excepted; which, when these fail, is to be kept in view as the only resource upon which we are to depend.

2. Incontinence of urine is a frequent effect of palsy; and it would appear, that the sphincter of the

bladder sometimes loses its contractile power, while the natural tone of the muscle termed detrusor urinæ, which constitutes the chief part of the body of the bladder, remains entire. In this variety of the disease, the obstinacy of the paralytic affection with which the constitution is attacked, commonly renders fruitless every attempt to remove it. But the most obvious remedies to be employed for it, are, tonics, particularly Peruvian bark, chalybeates, and especially the cold bath general and local. The local application of cold to the perinæum has frequently a powerful influence: cloths wet with vinegar and cold water, or with a strong solution of saccharum saturni in vinegar, prove sometimes useful; but the most effectual method of applying cold, is by dashing water upon the loins, perinæum and fundament.

3. Incontinence of urine is not an unfrequent effect of laceration in the operation of lithotomy in male subjects; and in the same operation, and by violence done to the parts in delivery, in females. It ought, however, to be remembered, when in the lateral operation much laceration is produced, that in general it proceeds from the muscles not having been divided with sufficient freedom by the knife; and accordingly, except in cases of large stones, incontinence of urine seldom succeeds to this operation when properly performed.

As the disease in this case depends upon nearly the same cause as that which I mentioned last, namely, on a loss of power in the retaining parts, the same remedies are proper; and by due perseverance, particularly in the use of cold bathing, many are at last very completely cured of this variety of the disease. But it frequently happens, in all the varieties of the disease, that no relief is obtained from any remedy whatever; in which case, it becomes an object of importance to prevent the urine from incommoding the patient, which never fails to happen, if means are not employed to prevent it.

When it proceeds from either of the last mentioned causes, namely, from a paralysis of the sphincter of the bladder, or from laceration, compression of the urethra answers the purpose; as the pressure can be so modified as to be applied and removed at pleasure. Nuck invented the first instrument for this purpose of which any description is given. The jugum, or yoke, as it is termed, Plate LXXVII. fig. 1. is an improvement upon this; and, when properly fitted, it answers the purpose exceedingly well. When lined with quilted silk or velvet, it fits easily on the penis, and by means of the screw, the pressure can be made sufficiently tight. For women another invention is necessary, as the pressure must be applied through the vagina. Pessaries of resina elastica, and of sponge, have been proposed for it, but those of ivory or lignum vitæ answer better: in Plates LXXIV. and LXVI. are represented pessaries of different kinds.

Pessaries should all be finely polished, and dipped in oil immediately before being introduced. After being passed into the vagina, the pessary should be placed directly across, so as to press with as much effect as possible against the urethra.

This method of obviating the inconveniencies arising from incontinence of urine, by pressure, is not, however, applicable when the disease proceeds from irritation about the neck of the bladder; for the continual desire to pass water, with which patients in such circumstances are tormented, renders every attempt to suppress a complete discharge of it totally inadmissible. It is therefore a point of the first importance to distinguish between the different causes of this symptom; for it is obvious that a remedy that may be well calculated for one variety of the disease, may prove highly prejudicial in others.

Whenever it is found that pressure upon the urethra is improper, or that it does not answer, relief may commonly be obtained from a machine properly fit-

ted to serve as a reservoir for the urine. The instruments formerly referred to, represented in Plates LV. and LXXVII. have been often used, and commonly with much advantage. They should be made so as to apply as closely as possible to the parts on which they rest ; and when properly fixed to a circular bandage round the body, they remain sufficiently firm, and at the same time admit of every necessary change of posture in ordinary exertions of the body. The last of these instruments, namely, the one delineated in Plate LXXVII. fig. 2. proves useful only in men ; but the other, Plate LV. fig. 2. may be employed for women also.

CHAPTER XXXI.

OF SUPPRESSION OF URINE.

THE subject of the preceding chapter, namely, incontinence of urine, proves always troublesome and inconvenient; but the disease that we are now to consider, proves in every instance, very alarming, and often ends in the death of the patient.*

A suppression of urine may be the effect of various causes, and in the method of cure a nice discrimination of these is necessary.

1. In the preceding chapter we have seen, that incontinence of urine is often produced by the sphincter of the bladder becoming paralytic, while the detrusor urinæ still retains its power of contraction. In like manner, a suppression of urine frequently occurs in palsy, and seems to proceed from loss of power in the body of the bladder, while the sphincter still preserves its usual power of retention.

Although this variety of the disease is often connected with palsy of all the under part of the body, yet it is frequently induced by the pernicious custom of remaining too long, especially when drinking freely of diuretic liquors, without voiding urine; by which the bladder is sometimes so far overdistended, that it loses entirely all power of contraction.

The catheter proves here commonly a very certain remedy when employed early, and it should always be advised as soon as it is found that the urine collected

* It is that variety of the disease to which I allude, in which the urine is collected in the bladder, but which the patient is unable to discharge. When suppression takes place from a morbid state of the kidneys, a variety of the disease is produced, that no surgical operation can relieve so that it does not fall to be considered here.

in the bladder cannot be passed. For although the use of this instrument should never be advised where it can with safety be avoided, yet as in the circumstances we are now considering, delay never fails to prove dangerous, the urine should always be drawn off as soon as the stoppage excites irritation. At the commencement of the disease, it is for the most part easily done; while long delay, by exciting swelling and inflammation about the neck of the bladder, never fails to render it both more difficult and more painful, and in some instances even impossible to pass the catheter. The method of passing the catheter, both in male and female subjects, is the same with the operation of sounding for the stone, already described in Chapter XXIX. Section II.

2. A suppression of urine is frequently produced in the last months of pregnancy, by the pressure of the uterus on the neck of the bladder. So completely indeed is the urine sometimes obstructed by this, that not a single drop can be discharged but with the aid of a catheter; and as this instrument is in females commonly introduced with ease, it should always be done as soon as the urine cannot be otherwise voided. Delay in using the catheter is often the cause of much distress. In different instances, the bladder has from this cause alone been distended to such a degree as to lose the power of contraction; and in a few cases, it has even burst entirely: we should not therefore hesitate to advise the catheter to be employed, on finding that the bladder is in any degree distended beyond its usual size.

3. Tumors in the vagina and neighbouring parts, when they become large, are apt to compress the urethra so much as to induce a total suppression of urine; and a prolapsus uteri is often attended with the same effect.

The method of treatment best calculated for removing a prolapsus uteri, as likewise the means of cure commonly employed in tumors in the vagina, will be

the subjects of different chapters; only it must be remembered, that till these views are accomplished, the urine should be regularly drawn off with the catheter, whenever it is collected in large quantities.

The very irritable state of the parts about the neck of the bladder that often prevails in suppression of urine, renders it necessary in some instances to use the catheter often. Instead of this, some practitioners have advised the common catheter to be allowed to remain in the bladder a considerable time at once, so as to admit of the urine being discharged as soon as it is secreted: but this is a practice that ought not to be admitted; for the irritation arising from a long continuance of a catheter in the bladder, commonly does more harm than we ever experience from a frequent use of it. When it is wished, however, to allow a catheter to remain in the bladder, either for this purpose, or for wounds in the urethra, the hard silver tubes in common use ought not to be employed: those that are prepared with *resina elastica*, answers the intention better, and I have found by experience, that they do not dissolve in the urine: in one case a tube of this resin was kept in the bladder twenty-two days without being hurt by the urine.

4. A stoppage to the flow of urine is not an unfrequent effect of an enlarged state of the prostate gland, and of obstructions in the urethra in virulent gonorrhœa. The treatment best suited to these affections will form the subject of part of the ensuing chapter.

Suppression of urine induced by stones impacted in the urethra, has been already considered in Section IX. of Chapter XXIX. where the remedy was pointed out.

5. But the most alarming variety of the disease, is that which proceeds from inflammation about the neck of the bladder, inducing pain and swelling to such a degree, as often make it impossible to pass the catheter.

Suppression of urine from this cause is not an unfrequent consequence of inflammation in gonorrhœa proceeding backwards along the urethra: it is sometimes, although not often, induced, by an unguarded use of stimulating injections; and as the bladder is equally liable with other parts of the body, to the influence of every cause that excites inflammation, whatever excites inflammation in other parts will very readily do so here.

In whatever way inflammation may be induced, the means of cure should be nearly the same: blood should be discharged from the arm in quantities proportioned to the strength of the patient, and a considerable number of leeches should be applied to the perinæum as near as possible to the seat of the disease, and allowed to bleed freely. Opiates should be given in large doses; injections of warm water or milk, whether by themselves or combined with opiates, should be repeatedly thrown into the rectum; and the whole body should be immersed in the warm bath. By these means, when the inflammation is not violent, the suppression will in some instances be removed before any distressful symptoms take place. But when these remedies do not prove effectual; when the bladder becomes painfully distended; and when every attempt to introduce the catheter has failed, other means of relief should be employed. In such circumstances, puncturing the bladder is the only remedy on which we can with certainty depend: being an operation of some nicety and hazard, arising not so much from the difficulty of doing it, as from the consequences that sometimes result from it, and the strict confinement that for a considerable time it entails upon the patient, it ought never to be advised till the other remedies I have mentioned have been tried in vain; at the same time, however, I think it right again to observe, that it should never be long delayed after our other means of relief have been found to fail.

The bladder may be punctured in various ways : it may be done a little above the pubes : the membranous part of the urethra, and prostate gland may be cut, and an opening made in the neck of the bladder. An opening may be made from the perinæum, directly into the body of the bladder ; and a puncture may be made in the back part of the bladder by passing a trocar into it from the rectum. As the method of puncturing the bladder, after dividing the membranous part of the urethra and prostate gland, is obviously more hazardous than any of the others, it is now very deservedly laid aside, so that it is not necessary to speak of it farther. We have, therefore, only to consider the other three modes of operating.

In puncturing the bladder above the pubes, we are directed by authors, first to make an incision, two inches in length, through the common teguments and muscles, and then to perforate the bladder with a trocar. But there is no necessity for this extensive division of the teguments and muscles ; for the operation may be done with equal safety and with less pain to the patient, by pushing a trocar at once through the skin, muscles, and bladder ; and it may be entered any where from the height of half an inch to an inch and half above the pubes, and at half an inch or thereby on either side of the linea alba. Some advise the trocar to be passed obliquely downwards, with a view to prevent the back part of the bladder from being hurt ; but we act with more safety, and guard with more certainty against this injury to the bladder, by making use of a short canula, and passing the trocar nearly in a horizontal direction ; for, in passing it obliquely down towards the centre of the pelvis, the bladder, on being left empty, would, in a great proportion of cases, be apt to slip off from the end of it, by which the urine would be extravasated, and lodge in the contiguous parts. As soon as the trocar has pierced the bladder, the stilette should be withdrawn, and the canula secured in its situation with pieces of

ribbon or tape connected with it, tied to a circular bandage, passed round the body.

The length of the canula used in this operation is, I may remark, a point of the first importance, and merits particular attention ; for much inconvenience would arise from its being too short, while a long canula, as I have already observed, is apt to injure the back part of the bladder. Of this we have an instance on record, in which the end of the canula was found, after death, to have penetrated not only the back part of the bladder, but even the rectum.*

In corpulent people, the canula may require to be two, three, or even more inches in length, according to the quantity of fat between the skin and bladder ; but in thin patients, I know from experience, that an inch and half is sufficient.

The canula, it must be remembered, should be retained in its situation till the cause of the obstruction is so far removed, that the urine can be passed in the usual manner ; but it has been very properly remarked,† that a canula cannot be kept above ten or fourteen days in the bladder, but with the risk of contracting a calculous crust, that renders its extraction both difficult and painful. The canula, therefore, should be taken out and cleaned, from time to time. This has commonly been done, by passing a firm probe of a sufficient thickness through it into the bladder, upon which the canula is again returned, on being cleared of the incrustation. Instead of a probe, however, I have employed a tube that answers better. This tube is made to fit the diameter of the canula exactly, but at the same time to pass easily through it ; and it has this advantage over a probe, that in the event of its proving difficult to return the canula of the trocar, as sometimes is the case, the tube may be retained ; and being nearly of the same diameter, it answers the pur-

* Vide Sharpe's Operations of Surgery, Chap. XV.

† Vide Critical Enquiry, &c. by Mr. Sharpe, Chap. IV.

pose equally well. Of this tube, and the mode of applying it, I have given a delineation and description in Plate LVI. and in Plate LVII. I have delineated a very neat apparatus for puncturing the bladder above the pubes, by Dr. Monro.

In puncturing the bladder from the perinæum, the patient should be placed upon his back on a firm table; and his thighs being separated, and properly secured by assistants, an incision should be made of an inch and half in length, beginning at the commencement of the membranous part of the urethra, and proceeding towards the anus, in a line parallel to, but at least half an inch distant from, the rapha perinæi. In this manner the skin and cellular substance should be freely divided; which puts it in the power of the operator not only to introduce the trocar with more ease, but to avoid the urethra with more certainty than he otherwise could do.

This being done, as the bladder is always much distended when this operation is necessary, it is easily distinguished with the finger at the bottom of the wound: but, whether it is felt by the finger or not, we should not hesitate to push in the trocar a little above, and to the left of the prostate gland, which, when the parts have been freely divided, is easily discovered; and if the point of the trocar is passed up towards the pubes, there can be no danger of hurting either the ureters or vasa deferentia, which some have been afraid of in this operation; and at the same time there must be an absolute certainty in this direction, if the trocar is carried to a sufficient depth, of its reaching the bladder.

It has been alleged, and with some reason, that in this part of the operation the surgeon must be at a loss to know when the instrument has reached the bladder; and several inventions have been proposed, to obviate this inconvenience. In Plate LXXIII. fig. 5. is represented a very simple contrivance for this purpose: it consists of a trocar, with a canula of the usual form, and a deep groove in the stylette, so that urine begins

to flow along the groove, immediately on the instrument having entered the bladder. As soon, therefore, as in this manner we know that the trocar has passed to a sufficient depth, the filette should be withdrawn; when the canula should be secured by two pieces of tape, connected with two rings upon its brim, being firmly tied to a circular bandage round the body: and if one of these tapes is tied behind immediately above the sacrum, and the other directly above the pubes, the canula will not be easily displaced.

It is equally necessary here as when the operation is done above the pubes, to change the canula, or at least to clean it from time to time; and in this situation too, so long as a canula is employed, the urine may be retained and drawn off at pleasure, by a plug of cork being fixed in it.

In perforating the bladder from the rectum, the patient should be placed upon his back, and secured with assistants in the manner I have pointed out: the surgeon now inserts the forefinger of his left hand into the rectum, and having carried the point of it about an inch above the prostate gland, where the bladder in this distended state of it is easily felt, a curved trocar about two inches and a half in length, should be passed along the finger, and pushed at this prominent part of the bladder, in an oblique direction upwards till it reaches the urine. In this situation, the canula must either be retained by being fixed with pieces of small tape to a circular bandage round the body, or a tube of *resina elastica* should be inserted through it, and left in the opening till the urine passes off by the urethra.

This operation has now been frequently practised, but it is liable to so many important objections, that I do not suppose that it will ever be generally adopted. It is easily performed, but this is almost the only circumstance that tends to recommend it. The chief objections to it are, the risk incurred by it, of wounding either the ureters, *vasa deferentia*, or *vesiculæ se-*

minales, while, at the same time, it forms a passage, by which the fæces may find access to the cavity of the bladder, that would either soon end in the death of the patient, or leave him in a state of very miserable existence. Much irritation and distress must also ensue from a canula being left in the rectum during the cure, that is, till the urine passes off by the natural conduit of the urethra, which, in some instances, does not happen in less than a year or two, while in others the stoppage continues during life. Mr. Weldon, who has written an ingenious treatise on this subject, indeed says, that the canula may be withdrawn soon after the operation, and the urine allowed to pass off by the opening.* But, besides the very uncomfortable state to which this would reduce the patient, by having his urine at all times passing off by the rectum; the opening would often be apt to heal from time to time, by which the operation might be frequently to renew.

I have thus described the different modes that have been proposed of puncturing the bladder. In appreciating the merits of each, I was at one time of opinion, that doing it from the perinæum was the best; and in the former editions of this work, I freely said so. I now, however, think it right to say, that farther experience has convinced me that I was wrong. Every method of performing this nice operation, is attended with difficulties. I have already enumerated those that chiefly apply to the mode of doing it from the rectum. To the perforation above the pubes, it is objected, that the cavity of the abdomen may be pierced with the trocar; that the bladder may be injured, by being suspended for a considerable time upon the canula; that it may even slip off from the end of the canula, by which all the urine will escape, and lodge in the pelvis; that the end of the canula may injure

* Vide Observations on the different modes of puncturing the bladder, by Walter Weldon, surgeon.

the back part of the bladder; and that the urine, insinuating into the cellular substance of the contiguous parts, may terminate in various distressful symptoms.

It may be observed, however, in answer to these difficulties, that where the operation is properly conducted, few or none of them ever occur. It can seldom or never be necessary to puncture the bladder, till it is so much distended with urine, as to be considerably raised above the pubes; in which situation, there is no risk of pushing the trocar into the abdomen. A suppression of urine may no doubt happen, where the bladder, by disease, is so much contracted, that this degree of distention cannot, consistently with the safety of the patient, be permitted. I conclude, however, that this is uncommon, as I have never yet met with it; and wherever it takes place, the diseased state of the bladder will give little or no chance to the operation, wherever it may be performed. I know from experience, that the bladder is not apt to be hurt by being suspended on the canula; and I conclude that this may, in some measure, happen, from those attachments that commonly take place in this disease, between the bladder and contiguous parts, as the effect of the inflammation, with which a suppression of urine is for the most part attended. Those adhesions of the bladder to the contiguous parts, may also in some measure tend to prevent the bladder from slipping off from the canula; but this accident can never possibly happen, if the trocar is not introduced with too much obliquity downwards. Neither will the back part of the bladder be hurt by the canula, if the directions I have given, in regard to the length of it, are kept in view, and if the blunt silver stopper, Plate LVI. fig. 3. is always kept in it, except when the patient is voiding urine.

That distressful symptoms may ensue, from the urine finding access to the contiguous cellular substance, none will doubt, but I have now much reason to think that it is an uncommon occurrence in this operation.

In perforating from the perinæum, to which at one time I gave the preference, the urine is still more apt to escape from the wound, into the contiguous cellular substance ; although this is by no means the most important objection to the operation being done in that situation. The chief danger here, arises from the near contiguity of very important parts, the urethra, prostate gland, ureters, vasæ deferentiæ, and vesiculæ seminales, which being all near the neck of the bladder, and therefore apt to inflame, whenever the urine is long suppressed, they must necessarily be more severely injured, by the trocar passing near them, and by their being freely exposed to the air, by the deep incision in the previous steps of the operation, than the upper part of the bladder can possibly be, in perforating above the pubes, and accordingly more danger is found to attend it.

I am therefore of opinion, on a comparative view of the advantages and disadvantages of these several operations, that puncturing the bladder above the pubes is the best. I have only further to observe, before leaving the subject, that in whatever way the operation is done, it should not be long postponed after the bladder becomes painfully distended : I have often indeed been led to think that more danger has ensued from delay in this situation, by which the bladder has appeared to be entirely deprived of its tone, than we almost ever meet with from the most untoward occurrence in any of these modes of operating.

In the operation of lithotomy in females, I mentioned reasons that appear to be conclusive against the method of cutting into the bladder from the vagina ; but they do not apply with equal force against the propriety of puncturing the bladder in this part. On the contrary, whenever there is cause for performing this operation in women, it cannot be done in any other way, either with such ease or certainty, as from the vagina. When the bladder is much distended with urine, it is easily discovered by the finger in the

vagina ; and from thence it may with safety be pierced with a trocar. The forefinger of the left hand being passed into the vagina, the point of the trocar should be conducted upon it, and pushed through the vagina into that part of the bladder first discovered by the finger ; for here the ureters run no risk of being wounded, which farther back they certainly would do. The trocar being freely passed into the bladder, and the urine all evacuated, the canula should be left in its place, and continued as long as the cause subsists by which the suppression was produced. That the tube may be firmly secured, it should be of a sufficient length for passing out at the vagina, and to admit of its being tied to the T bandage, with tapes attached to it.

I think it here, however, proper to observe, that in whatever way the bladder is punctured, and whether in male or female patients, if tubes of silver irritate and excite pain, as is very apt to be the case, that this may in most instances be prevented by leaving in the passage a tube of elastic resin.

CHAPTER XXXII.

OBSTRUCTIONS IN THE URETHRA.

IN the preceding section, when treating of the causes of suppression of urine, obstructions produced by claps, of which caruncles are supposed to be the most frequent, were spoken of as the most frequent and most remarkable.

But although I have particularly mentioned the term caruncle, by which is meant a fleshy excrescence arising from the membrane of the urethra, I do not wish it to be supposed that I consider it to be a frequent occurrence. That such excrescences are sometimes met with towards the extremity of the yard, there is no reason to doubt; but as I have often dissected these parts, in patients who had long laboured under symptoms supposed to proceed from caruncles in the back part of the urethra, and as caruncles were not discovered in any of them, I am therefore of opinion that their existence in the more remote parts of the urethra is very uncommon. I have often observed this kind of production, within a quarter of an inch of the extremity of the urethra, especially where the glans and prepuce have been covered with warty excrescences of a similar nature; but from having never found them spread farther up the canal, although it is not a proof that they never occur in other parts of it, yet this, together with some observations of a similar nature by Dionis, Saviard, Mr. Petit, and others, is sufficient authority for the opinion I have advanced, that caruncles in the more remote parts of the urethra are rarely met with. Daran indeed often speaks of them; and he no doubt had more practice in diseases

of this class than perhaps ever fell to the share of any other individual : but if his works are read with attention, it will appear that his detail is very inaccurate ; for he evidently confounds other causes of obstruction, particularly strictures and cicatrices of old ulcers, with, and mistakes them for, caruncles.

Practitioners in former times, as well as many in more late periods, have doubted so little of the frequent occurrence of caruncles, that almost every instance of obstructed urethra succeeding to a clap has been attributed to this cause. What I have here set forth will tend to set this however in a different view ; and I shall now proceed to enumerate the different causes by which obstructions in the urethra may be produced.

1. Although I have said that caruncles are rarely met with in the superior part of the urethra, yet they sometimes form towards the extremity of this canal : they must therefore be mentioned as one cause of these obstructions. I must again observe, however, that where caruncles, or carnosities as they are sometimes termed, are met with, they are always of the same nature with those warty excrescences that frequently form upon the prepuce and glans as a consequence of gonorrhœa.

2. Ulcers in different parts of the urethra have been known to produce very complete obstructions.

On opening the bodies of those who at the time of death laboured under gonorrhœa, ulceration has very seldom been discovered ; and this gave rise to the opinion that ulcers of the urethra never take place in gonorrhœa. We now know indeed that very great quantities of matter may be furnished by parts merely inflamed, and not in a state of ulceration. But we also know, that parts remaining for any considerable length of time so highly inflamed as to furnish much pus, are very apt to become ulcerated ; and if this happens in other parts of the body, we may conclude that the same cause will induce the same effects in the

urethra. Accordingly, there is no reason to doubt of ulcers arising in the urethra from inflammation alone; but it is likewise certain, that they are sometimes met with in the urethra from the same cause by which chancres are produced in the glans, namely, from the mechanical effects of the venereal poison, independent of the intervention of any degree of inflammation.

The excretory ducts of the different glands in the urethra, particularly of the prostate gland, as also the ducts of the vesiculæ feminales, and the other parts about the verumontanum, have commonly been supposed to be particularly obnoxious to the effects of the venereal virus; and ulcerations are accordingly said to be more frequent in these parts than in others. The result of my observation, however, has been, that ulcers seldom occur in any part of the urethra, but more frequently towards the extremity of the urethra than in other parts of it, and that they rarely form farther back than an inch or so from the point of the yard.

3. Dissection has shewn, that a mere contracted state of the urethra is to be considered as the most frequent cause of obstruction. In some, the stricture is confined to one point, while in others different parts of the passage are diseased. At one period, I was induced to think that strictures in the urethra were more frequently produced by ulceration than in any other way; but I have now reason to think, that they proceed more frequently from that thickened state of the membrane of the urethra that gonorrhœa is apt to excite.

Astringent injections are mentioned by many as a frequent cause of strictures. Irritating injections, when improperly applied to parts already in a state of inflammation, may no doubt do harm; and, by increasing the inflammatory state of the urethra, may in this manner produce strictures: but this is not the fault of the remedy, but of the improper use of it. Similar

objections might with equal reason be adduced against the use of every medicine with which we are acquainted; for few remedies are more safe in their operation, or more effectual in the cure, than astringent injections in gonorrhœa. Obstinate claps indeed are often cured by injections that cannot be removed in any other way.

4. Tumors in the cellular substance surrounding the urethra, or in any of the glands connected with it, very frequently produce obstructions in the course of it: and inflammation, whether at first produced by gonorrhœa, or in any other way, when it terminates in suppuration, must be apt to induce them. In such cases, indeed, as soon as the matter collected in the abscess is discharged, the obstruction produced by it is in general removed: in some instances, however, this does not happen; for in different cases I have found, that the compression produced by the tumor has induced such firm adhesion between the sides of the urethra, as to obliterate the canal entirely. In which case, as a total stop is put to the natural discharge of urine, it bursts out in the perinæum, where one or more openings, communicating with the urethra, are found between the seat of the disease and the prostate gland.

5. Of all the causes of obstruction, none are so frequent as a fulness or enlargement of the corpus spongiosum urethræ. On dissecting the penis of such as have laboured long under obstructions, a partial enlargement or thickening of the substance of the urethra, often appears to be the cause, and it frequently proceeds so far as to obstruct the passage entirely.

In some, the stoppage is confined to a particular point: in others, it is of considerable extent; while not unfrequently it attacks different parts of the canal, leaving intermediate parts perfectly sound.

6. Having thus enumerated the causes that most frequently produce obstructions in the urethra, I shall

now endeavour to point out the treatment best calculated for their removal.

When the obstruction is produced by the pressure of a tumor, our practice must depend on the kind and nature of the tumor. Accordingly, when the tumors are hard and indolent, they ought to be extirpated whenever it can be done with safety. But although this may be done when they do not penetrate deep, yet when the prostate gland, or any of the parts about the neck of the bladder, are found to be enlarged, the removal of these cannot possibly be attempted. In such desperate cases, cicuta has been often used; but seldom, I believe, with advantage. In an ulcerated state of the parts, a plentiful use of uva ursi has been known to give relief, and some advantage has occasionally been derived from a gentle course of mercury. The effect, however, of mercury, in all affections of this kind is by no means certain; and in the distress that this variety of the disease excites, we are frequently reduced to the necessity of trusting entirely to the relief which opiates give, and to a plentiful use of mucilaginous drinks.

When, again, the tumors proceed from inflammation, if they are not soon dissolved, the most effectual means should be employed for bringing them to suppuration.

These having been enumerated in Chapter I. it is not necessary to repeat them, and as soon as the formation of matter is accomplished, it ought to be discharged. In other parts of the body, when an inflammatory tumor is likely to terminate in suppuration, we consider it as good practice not to open the abscess till pus is thoroughly formed; but in this situation, as much distress would ensue from delay, the abscess should be opened as soon as there is cause to imagine that the pressure upon the urethra would be diminished by doing so; and this must always be the case when a fluctuation of matter is evidently discovered. In all such cases, we remove the obstruction

in the urethra with more certainty by discharging the matter contained in the abscess than by any other means. If, on laying the collection open, however, it is found that the stoppage in the urethra is not removed, bougies should be immediately employed. By passing a bougie of a proper size along the urethra, and allowing it to remain for two or three hours daily, any stricture produced by the pressure of the abscess will soon be removed.

It sometimes happens, where abscesses in this situation have been of long duration, that the urine bursts into the cellular membrane of the perinæum and other contiguous parts, and from thence forms one or more external openings. One of the most distressful situations is in this manner induced, to which the human body is liable, a disease of which we shall more particularly consider in speaking of fistula in perinæo. In the other cases of obstructed urine, proceeding from caruncles when they happen to occur; from ulcers, and the cicatrices which they produce; from stricture and contraction of the urethra; or from an enlarged and thickened state of the corpus spongiosum urethræ, we depend almost entirely on a proper application of bougies, a remedy that proves chiefly useful by its mechanical action on the obstructed part. It has been alleged, indeed, by many, particularly by Mr. Daran and Mr. Sharpe, that, in removing caruncles and other causes of obstruction, bougies prove more useful by what they term their suppurative quality, than by any other property: by which they mean to say, that bougies may be composed of such materials as will induce a suppuration upon the caruncles to which they are applied; and that this suppuration, if continued for a sufficient length of time, will ultimately destroy all the diseased parts.*

* For Mr. Daran's account of this matter, see his *Treatise on Diseases of the Urethra*: and Mr. Sharpe's account of it may be seen in his *Critical Enquiry*, chap. vi. Although Mr. Sharpe is clearly of opinion, that the principal advantage derived from bougies proceeds from their influ-

This idea, although founded on inaccuracy, continues with many still to prevail : little argument, however is required to shew that bougies act chiefly by their mechanical pressure, and not by the suppuration which they excite. Among other reasons that might be given as proofs of this, I shall only mention the following.

1. Those who allege that bougies prove useful only by inducing suppuration, are obliged to affirm that obstructions to the passage of urine arise most frequently from caruncles in the urethra ; and that the suppuration produced by the bougies, tends to destroy, or as it were to dissolve, them ; but although these excrescences may sometimes prove the cause of obstructions, yet, as I have already endeavoured to shew, they are very rarely met with. It must therefore follow, if this idea of the cause of the disease is ill founded, that the supposed *modus operandi* of the remedies employed in it must likewise be erroneous ; for every practitioner who gives attention to this branch of his profession, must acknowledge, that bougies prove much more frequently useful than the cause upon which they have been supposed chiefly to operate is found to exist. Indeed, the general utility of bougies in obstructions of the urethra, must be acknowledged by all who have used them, while scarcely any advantage is derived from any other remedy.

2. But although we should allow that caruncles are frequently formed in the urethra, we cannot admit that suppuration induced upon them would have much influence in removing them.

ence in inducing suppuration, yet, whenever he argues on this with accuracy, he is obliged to acknowledge, that by their pressure alone they prove useful : for he says, " That though I have a great opinion of the good effects produced by the suppuration, yet I believe also, that bougies operate by distending the urethra ; and I will go so far as to give it as my judgment, that even the cures done by Mr. Daran are wrought partly by distention, and partly by suppuration ; though he himself ascribes them to suppuration only." Vide page 171, fourth edition, *loc. cit.*

We know, that in other parts of the body, warts and other hard excrescences cannot be carried off merely by matter being formed upon them ; and we cannot suppose that in this there is much difference between warts in the urethra, and those which form in other parts of the body.

3. It has been said, that these bougies, while they act by inducing suppuration, have likewise some influence as escharotics ; and that many of Mr. Daran's bougies, the composition of which was kept secret, were evidently possessed of this property. Mr. Daran, in order to render the operation of his remedy as mysterious as possible, did indeed allege, that his bougies were endowed with many virtues : but no candid practitioner will say, that bougies possessed of a degree of causticity sufficient to destroy warts, can with propriety be passed into the urethra ; for, if of such a strength as to corrode these excrescences, they would necessarily injure the whole of the urethra to which they are applied. Indeed, the mildest materials we can employ frequently stimulate too much : for, upon withdrawing any bougie that has remained long in the urethra, it is almost always found covered with purulent matter. It is this indeed I imagine, that first suggested the idea of bougies acting by inducing suppuration ; which, however, is to be considered only as a necessary effect of a stimulus applied to a sensible membrane, being in no respect essential to the cure of the disease for which the bougie is used.

4. But without having recourse to the suppurative or escharotic effects of bougies, the advantages commonly derived from them may, as I have already endeavoured to shew, be easily explained upon the principle of mechanical pressure alone.

I have thus thought it proper to consider the action of bougies with minuteness ; for till the opinion is exploded of medicated bougies, as they are termed, being necessary, much mischief may be done, by forming them of irritating or even of escharotic materials, as is

sometimes the case, instead of rendering their composition mild and inoffensive, as in every instance it ought to be.

The opinion that I have endeavoured to establish being admitted, namely, that bougies should operate solely by mechanical pressure, it must necessarily follow, that, in the formation of bougies, much will depend on their being of a proper consistence; neither too hard nor too soft. When too soft and compressible, they cannot act with advantage against the obstructing cause, and against which pressure is intended to be applied; and when too hard, they are apt to crack, and are neither introduced into, nor retained in the urethra, with so much ease as when formed of a proper consistence: bougies ought likewise to have a smooth polished surface, to facilitate their introduction; and lastly, they ought, as I have already remarked, to be composed of very mild materials, so that they may excite as little irritation as possible.

Various formulæ have been given for bougie plasters; and of these the following are perhaps the best.

No. 1. R. Emplast. Diachyl. simp. ℥iv.

Cer. puriss. ℥iss.

Ol. Oliv. opt. ℥iii.

No. 2. R. Emplast. commun.

Spermat. Cet. aa ℥iv.

Ol. Oliv. opt. ℥fs.

Minii, ℥fs. M.

No. 3. R. Emplast. commun. ℥vi.

Ceræ flavæ puriss.

Spermat. Cet. aa ℥ii.

Ol. Oliv. opt. ℥i.

Antimon. crud. pp^{tt}. ℥fs. M. S. A.

Any of these prescriptions afford a good composition for bougies. They require to be slowly melted, and the different articles to be well mixed together. No. 1. is the simplest, and perhaps the best; the red lead in No. 2. and antimony in No. 3. being added chiefly for the purpose of affording a variety of col-

our. No. 4. is a composition for bougies recommended by Mr. John Hunter;* and No. 5. by Mr. Sharpe.†

No. 4. Take oil of olives, three pints;

Bees wax, one pound;

Red lead, one pound and a half.

Let them be boiled together on a slow fire for six hours.

No. 5. ℞. Diachyl. cum pice Burgund. ℥ii.

Argent. viv. ℥i.

Antimon. crud. pp^{tt}. ℥ss.

The quicksilver to be previously dissolved in balsam of sulphur, or in honey, and added to the plaster when melted in a moderate heat.

Any of these compositions, when boiled to a proper consistence, will answer for the formation of bougies, which is done in the following manner: while the liquid still continues warm, let a piece of fine old linen be dipped in it, taking care with a spatula to cover the whole. If the melted liquor be of a proper heat, no more of the plaster will adhere to the linen than is necessary; but as air bubbles are apt to arise and produce inequalities on the surface of the cloth, the spatula made use of should be somewhat warmer than the plaster, and by means of it the whole should be made smooth. The plaster might indeed be spread entirely with the spatula; but this is not only attended with more trouble, but it does not cover the cloth with sufficient equality.

The cloth being sufficiently cold, may be immediately formed into bougies, and the whole should, in the first place, be cut into the number that is meant to be made. The most exact method of doing this is by means of a sharp pointed knife, directed by a rule. The pieces should be eleven inches in length for bougies of a full size; but they should likewise be kept of all the variety of lengths for strictures of different heights in the urethra.

* See Treatise on the Venereal Disease, p. 137.

† See Critical Enquiry by Samuel Sharpe, F. R. S.

A variety of directions have been given for the form of bougies. Some advise them to be made nearly of an equal thickness to within an inch of their smallest end, and to taper from that to the point, while a great proportion of them are made to taper to within an inch or two of the point, and the rest of them are cylindrical. I once thought that this last form of bougie was the best; but after a long course of experience in this branch of business, I am now convinced, that bougies, which taper equally from one end to the other, are the best, and that this form answers equally well for every variety of size. They are introduced more easily, and with less pain than any of the others; the linen should therefore be cut in such a manner as to give this form to the bougies. When rightly spread, and the linen sufficiently fine, a well shaped bougie will be formed of a slip of about five-eighths of an inch broad at its largest end, and somewhat more than three-eighths at the smallest end. This forms a bougie of a middle size; for particular purposes they must be considerably larger, and for others not so large by a great deal.

The slips of linen are now to be rolled up as neatly as possible with the fingers; and in order to give them a smooth polished surface, they should be smartly rolled between a piece of smooth hard timber and a plate of fine polished marble: this being continued till the whole are rendered perfectly smooth and firm, and their points being properly rounded, in order to facilitate introduction, they are in this state to be kept for use.

These directions will convey an idea of the method of preparing bougies, but no surgeon can ever become so expert in forming them as artists daily accustomed to prepare them in large quantities. I must here, however, remark, that bougies, properly prepared with *resina elastica*, are preferable in many circumstances to such as are made with any kind of plaster. They not only prove much more durable, but more force

can be employed with them, and as they do not break or crack by continuing in the urethra, they remain in it with less pain and inconvenience than any other bougie that has yet been invented.

Catgut has frequently been used as a bougie; but after various trials being given to it, I do not find that it answers the purpose: it cannot be made sufficiently smooth; and it sometimes swells so much as to excite a good deal of irritation; and lead, which was one of the first articles used for bougies, is so firm that it always creates much pain, while it is so apt to break, that different instances having occurred of this, it has now been long laid aside.

We come now to the application of the bougie. A bougie must be chosen adapted to the size of the passage through which it is to pass, and well covered with fine oil: the penis being firmly grasped and extended with one hand, the end of the bougie must be inserted into the urethra with the other; and being pushed forward with caution, it is in this manner to be carried on till it meets with the cause of obstruction; when, if a moderate force makes it pass, our object is so far accomplished: but if, after different attempts, it cannot be easily carried forward, it should be immediately withdrawn; and at next trial, which, in order to avoid any risk of inflammation, should not be made for two or three days, a bougie with a smaller point should be employed.

Much nicety is required in this part of the operation; for, by proceeding slowly, with due care and caution, every risk may be avoided of injuring the urethra, at the same time that the object in view may be often accomplished with more certainty than when much force is employed. As soon as we reach the cause of obstruction, if a bougie of the smallest size is employed, instead of pushing it on with force, as to a certain degree may be done with a catheter, it answers the purpose with more certainty to twirl it between the finger and thumb, so as to make it press moder-

ately upon the part that it ought to pass. But, on the other hand, although mischief has often accrued from too much force being used with bougies, and although every practitioner should therefore be warned of the danger ; yet, when much resistance is met with, they must necessarily be pressed on with firmness. If this, however, is done with caution, and in a proper direction, which experience alone can teach, it may very commonly be accomplished. It often happens, indeed, unless a tolerable degree of force is employed, that bougies will not pass, and no benefit will therefore be derived from them ; for unless they are made to pass the point of obstruction, they cannot operate with advantage.

This, I must observe, is a point of much importance, and ought to be kept in view. For although no unnecessary force should be ever employed, yet we commonly meet with too much timidity ; for, in ordinary practice, if the bougie meets with unusual resistance, and if it cannot, on the first or second attempt, be introduced, the case is commonly considered as desperate, and no further trials are made. I can from much experience, however, say, that few cases occur, in which bougies, by a frequent repetition of cautious trials, may not be introduced. Even where I have been convinced that the passage of the urethra has at a particular point been entirely obliterated by the sides of it adhering to each other, and where the urine has long been voided by openings in the perinæum, the bougie, with a due degree of force properly applied, has at last proved successful.

In some instances, bougies with small points will pass, when others of a larger size will not penetrate ; but, in general, when the obstruction is found to be unusually firm, those of a middling size are preferable to such as have small points : for bougies of this form are apt to bend if they do not pass forward at once ; and as soon as the point yields in any degree, the bougie should be withdrawn, as it cannot afterwards be

pushed forward ; for if more force is employed, instead of being carried farther into the urethra, it becomes twisted, and excites pain in the extraction.*

By different cautious trials, the bougie will for the most part be made to pass the different points of obstruction ; and this being done, as bougies have sometimes slipped entirely into the urethra, and even into the bladder itself, this ought to be carefully guarded against, by a piece of cotton thread connected with the extremity of the bougie, being either tied round the penis behind the glans, or to a circular belt passed round the body.

Certain regulations have been held forth by authors for the time that bougies should be kept in the urethra : but with some patients they excite a good deal of pain, while with others they give little or none ; and as it is the degree of pain that they induce which ought to regulate the time that they remain in the urethra, nothing decisive, it is evident, can be said with respect to it. When they excite much pain, they should neither be allowed to remain long at once, nor should they be used above once in two or three days : but when they can both be easily introduced and retained in the urethra, they should be inserted often ; for as it is by their pressure alone that they prove useful, and as this must be continued for a certain length of time, according to the cause of the obstruction, the more constantly the bougie is used, the more quickly a cure will be performed ; and with the same view it should be gradually increased in size, till the largest can be inserted that the urethra will admit.

When bougies excite irritation, they should never be employed but when the patient can confine himself to his apartment ; but with many the distress that they induce is so inconsiderable, that they can walk easily

* With a view to give more firmness to bougies, Mr. Dease, an ingenious surgeon of Dublin, recommends their being formed upon catgut. Vide *Observations on the different Methods of treating the Venereal Disease*, by William Dease, Dublin.

with bougies of the largest size inserted along the whole course of the urethra. I always advise, however, the patient to remain at rest while a bougie is in the urethra.

Nothing certain can be said of the length of time that bougies should be used, as this must be always regulated by their effects; which, again, will in a great measure depend on the nature of the obstruction. This, however, I can with freedom propose, that they should be continued, not only while any difficulty in passing water remains, but for a considerable time thereafter.

In the use of bougies, care should be taken not to push them into the bladder: for, even when prepared of the best materials, a portion of the composition may crack and fall off; and if this should not pass off with the urine, it may be the cause of much distress, by serving as a nucleus for a stone.

Flexible catheters of various kinds have been invented for the purpose of remaining in the urethra, and for answering both the intention of catheters and bougies. Various methods of forming these instruments have been proposed; but the most convenient of any that I have seen, is either a tube of *resina elastica*, or one of flexible silver wire, wrapped spirally round a steel probe of a proper length and thickness; and this being neatly covered with fine linen spread with bougie plaster, and the probe upon which it was formed being withdrawn, the instrument is thus completed; only it must be afterwards furnished with a silver wire or cleanser, in a similar manner with other catheters. These instruments, however, do not prove so useful as was once expected; but when it is ever necessary to allow a catheter to remain long in the urethra, one of this flexible form answers the purpose exceedingly well. It must, however, be remembered, that as these catheters are covered with plasters, they should not be allowed to remain long in the bladder,

for the same reason that bougies ought not to be inserted into it. When it is necessary to leave a flexible catheter in the bladder, those that are composed of *resina elastica* should be employed, as the adhesive property of this substance prevents it from cracking and falling off, as plasters of every kind very commonly do.

When speaking of the formation of bougies, I have said, that as it is chiefly by mechanical pressure they prove useful, so a proper consistence is the principal circumstance to be kept in view in their composition. This, I must again say, should be our leading object in the employment of bougies : but when there is reason to think that chancres, or venereal ulcerations, exist in any part of the urethra, as nothing would cicatrise the ulcers so quickly as a local application of mercury, a large proportion of quicksilver extinguished in honey may with advantage be added to the composition, as in the formula given above, No. 5. As mercury in this state excites little or no irritation, it may be used with freedom. Red precipitate in fine powder has also been advised as a proper ingredient in bougies, not only to be applied in this manner to ulcers in the urethra, but with a view to corrode other causes of obstruction : this, however, is a practice that ought to be laid aside, as the precipitate is very apt to stimulate and inflame the membrane of the urethra.

I have thus entered fully into the consideration of the use of bougies. Indeed, too much attention cannot be given to a practice from which such important advantages may be derived : for by a proper application of bougies, almost every cause of obstruction that I have enumerated may be either cured, or at least greatly relieved ; and were it not for the advantages derived from bougies, almost every case of obstruction would terminate in the most complete degree of misery.

Before concluding the subject, I must not omit to mention the effect of bougies in some cases of troublesome gleets. Whenever this kind of discharge is kept up by an excoriation or slight ulceration of the urethra, or by any of the common causes of stricture, as is sometimes the case, no remedy proves so effectual as bougies; and even in ordinary cases of gleet, proceeding from a relaxed state of the excretory ducts opening into the urethra, nothing proves more certainly useful than the compression induced by bougies. Whether they operate by affording support to the relaxed membrane of the urethra, or by inducing some degree of inflammation upon the parts affected, I know not; but in many instances of obstinate gleet, bougies have been found to answer, when other remedies have failed.

Hitherto I have considered obstructions of the urethra in male subjects only; but the same disease also occurs in women: even in females, bougies are often used with advantage; but in women, tumors of such a size sometimes form in the urethra, as cannot possibly be cured by this remedy; and as the urethra in females is not only short, but much wider than in men, these tumors may in them be often removed, either with ligatures or with the scalpel. Nay, we know from experience, that a tumor adhering even to the bladder itself, may, in women, be taken off with safety. In such cases, there is a necessity for laying the urethra open; which may be done at either of the sides, and without any risk of wounding the vagina; and if an incision is here made with freedom, any tumor situated even near to the neck of the bladder, may be so far pulled down as to admit of the application of a ligature; and whenever this can be done, the attempt may be made without hazard.

A remarkable instance of this is related by Mr. Warner, where a tumor of the size of a turkey's egg, produced from the internal membrane of the bladder,

was extirpated with a ligature, and with most complete success.* When such tumors are not so large as totally to obstruct the urine, or to be productive of much distress, a prudent practitioner would rather decline to meddle with them. But when the reverse of this is the case, and when the urine is passed with difficulty, necessity points out the propriety of this operation; and it must be comfortable for a patient, in a situation that would otherwise be desperate indeed, to know that a remedy can with safety be employed from which a cure may be obtained.

It has been advised even by practitioners of reputation, when obstructions of the urethra proceed from caruncles, or carnosities, as they are termed, to destroy them with lunar caustic; and instruments have been invented for applying the caustic to the diseased parts, Plate CXV. figs. 1. 2. and 3: but the risk of injuring the contiguous parts, even when the caustic is guarded in the most cautious manner, is evidently so great, as must for ever prevent the practice from getting into general use.

This I still venture to predict, notwithstanding all that has been said by Mr. Everard Home in recommendation of the use of caustic: Mr. Home has no doubt removed obstructions in the urethra with caustic; but he has so frequently failed, after putting patients to severe pain, and after the most complete trials were given to his plan, that wherever it has succeeded, I have much reason to believe that due perseverance in the use of common bougies would have answered equally well; while no risk, and not the twentieth part of the pain, would have been the effect of their application: the clearest proof, indeed, that can be given of the inefficacy and danger of the use of caustic in obstructions of the urethra, is obtained from its having been laid aside after being put fully

* Vide Cases and Remarks in Surgery, by Joseph Warner.

to the test of experience more than a century ago, as well as from the practice being still confined almost entirely to the hands of Mr. Home; no practitioner of experience of whom I have heard, either in London, here, or elsewhere, having been induced to adopt it, after all the trials that have been made with it: this I have been led to say from the baneful influence which I have much reason to believe would result from the use of caustic in diseases of the urethra, were the practice ever to be generally adopted; and I speak to its inefficacy, not from doubtful speculation, but from ample experience.

CHAPTER XXXIII.

OF THE FISTULA IN PERINÆO.

BY the term fistula in perinæo is meant, a sinuous ulcer of this part, communicating most frequently with the urethra only, but in some instances directly with the body of the bladder. The term, however, is not strictly confined to this acceptation; for it is also applied to some ulcers of this part that communicate with the scrotum and penis.

The term fistula should with propriety be restricted to that variety of sinus in which the edges of the sore have become hard and callous; but custom now applies it indiscriminately to every ulcer that is not superficial, but which lies deep, and discharges its contents by one or more narrow openings in the external teguments.

In consequence of the latitude given to the meaning of the term fistula, many appearances are exhibited under this general denomination of fistula in perinæo. In some, a single opening is met with in the teguments of the perinæum or penis, discharging matter mixed with urine: this, in some instances, is not even accompanied with hardness or inflammation of the contiguous parts, but in others, instead of this simple form of the disease, along with one or more external openings communicating with the urethra, at which all, or at least the greatest part, of the urine is passed, the parts contiguous to these openings are much diseased. In some they are found merely hard or callous, without much enlargement; but in others they are not only hard, but much swelled, inflamed, and painful. In a few, this hardness and enlargement is confined to a small space; but most frequently,

when the disease has been of long continuance, it extends nearly from the anus to the scrotum, reducing the whole perinæum to a state of callosity. In many, the malady does not stop here: the scrotum, and even the penis, becomes diseased; and when the urine at last escapes into the cellular substance of these parts, particularly when it lodges in the scrotum, it never fails to excite a great deal of mischief.

In considering this disease, the causes by which it may be produced, first merit attention. They are in general as follow:

1. Wounds and other injuries of the urethra and bladder, in whatever manner they may be produced.

In the old method of performing lithotomy by the apparatus major, the parts were so much bruised and lacerated, that the wound seldom healed kindly, and frequently became fistulous; but when the operation is well performed, according to the present improved method, this seldom happens. From some cause or other, however, it happens in a few instances, that the urine does not flow freely by the penis; and finding a ready passage by the wound, it continues to come off in this manner, till the edges of the sore becoming callous, the disease in question is produced. In some, a direct communication is kept up between the neck of the bladder and the fore; but in others, the urine passes first into the urethra, and from thence is discharged by the wound in the perinæum.

Fistulous openings are sometimes the consequence of incisions made into the urethra, for the purpose of extracting stones that lodge in it.

2. Inflammation in any part of the urethra, by whatever cause it may be induced, if it terminates in an abscess, is very apt to corrode the membrane of this canal, and to produce a sinuous opening, at which the urine is discharged. This, I may remark, is not an unfrequent consequence of virulent gonorrhœa: for when the inflammation spreads along the perinæum towards the anus, if it be not quickly removed by

bloodletting, and such other means as are employed, it is very apt to terminate in suppuration.

Abscesses that form originally in the soft parts about the anus, are also known to give rise to it, by exciting inflammation and stricture, terminating in suppuration, in the cellular substance connected with the urethra.

3. The several causes enumerated in the last Chapter inducing obstruction of the urethra, by impeding the free discharge of the urine, frequently give rise to the disease now under consideration; and accordingly we find that fistulous sores in the perinæum are very commonly connected with an obstructed state of the urethra.

As the disease may thus be induced by various causes, it is necessary to have these in view in the course of the cure. In order, however, to render this very perplexing branch of practice as obvious and simple as possible, it is necessary to remark, that the different causes that I have enumerated, tend to the production of the disease by two general effects only:

1. By the formation of a passage directly into the urethra or bladder, either by external violence, or by the destruction of part of the membrane of the urethra, as a consequence of ulcers seated in it, or of matter collected in abscesses tending to abrade its substance; this, we suppose, may occur, independently of any obstruction to the passage of the urine.

2. By the sole influence of obstructions in the urethra: these, by putting a stop to the free evacuation of urine, at first induce a fulness and tension of the urethra, which, if not quickly removed, very commonly terminates in a complete rupture of this canal.

In the treatment, therefore, of this disease, we are to be directed by one or other of these general effects; and it is to be remarked, that in no disease is it of more importance to distinguish accurately between the causes by which it is induced. When the opening in the urethra has been produced by previous obstruction, no external application, nor any remedy direct-

ed to the system, will have any effect; while a proper and long continued use of bougies, by removing the obstruction, will seldom fail. And, on the other hand, when the disease has not originated from obstruction, but has been induced by a simple opening in the urethra, bougies are not only very unnecessary, but frequently do harm. This, I must observe, is a distinction not sufficiently attended to in practice. Affections of this kind are commonly treated with bougies only, whatever may have been the cause by which they were induced; but we shall soon make it appear that this must frequently be wrong.

In the cure of fistulous fores of these parts, it is a matter of the first importance to distinguish between such as are merely local, and those that are connected with any general disease of the system. For however well our means of cure might be directed to the topical management of the fores, if the patient at the same time laboured under lues venerea, scrofula, or scurvy, no permanent cure could be expected, if the disease of the constitution were not to be removed.

Where a fistulous fore is produced by strictures in the urethra, bougies is the only remedy we can trust; and when properly applied, they very commonly succeed. They ought to be continued till the strictures are entirely removed, when the urine being freely and easily passed, the fores which the strictures had induced, very commonly heal; but when they do not heal, the cure is for the most part found to be checked by the edges of the fores having become hard or callous; and till this state of the parts is removed, no progress towards amendment is to be looked for.

We are therefore to destroy these callous edges of the fore, as soon as it is found that the bougies do not succeed; and the method of doing it this: the patient must be laid upon a table, in nearly the same posture as in the operation of lithotomy; and a staff being introduced into the urethra, and made to pass the opening at which the urine is discharged, it is in this situa-

tion to be held firm by an assistant ; while the surgeon, introducing a small probe or director at the external opening of the fore, and cutting upon it in the direction of the sinus, is thus to lay it open through its whole length, till it terminates either in the urethra, or, if necessary, in the bladder itself.

When more sinuses than one are discovered, they must all be laid open in the same manner. In some instances, we meet with different sinuses in the cellular membrane, leading from one opening in the urethra ; while, in others, there are as many openings in the urethra as external fores or sinuses. This, however, is uncommon : but this is not a matter of importance, as the same method of treatment answers equally well in both ; for whether the different sinuses originate from one common opening in the urethra, or not, they ought all to be laid open from one end to the other.

In general, this simple division of the sinuses would prove sufficient ; but when any of the parts through which they run, have become uncommonly hard, a small portion of the diseased parts, contiguous to the fores, should be removed with the scalpel. This, however, is not always necessary, as the inflammation and consequent suppuration, induced by the mere division of the sinus, very commonly removes every slight degree of callosity ; but when the hardened parts are extensive, and too considerable to be removed in the course of the subsequent suppuration, such a proportion of them should be cut off with the scalpel, as might not probably be removed in this manner. This, however, is a point on which nothing decisive can be said ; for the necessity of removing a portion of these diseased parts, and the quantity to be removed, must, in all such cases, be left to the judgment of the operator.

After all the sinuses have been freely divided, the staff should be withdrawn, and the divided parts gently separated, by the introduction of soft lint spread with any emollient ointment, in order to prevent their

immediate reunion. But although some easy application should for this purpose be inserted between the lips of the wound, it ought to be done with caution ; for stuffing or cramming the fores, as is sometimes done, always does harm, and often renders all the other steps of the operation abortive. The fores are now to be covered with a pledget of emollient ointment ; and proper compresses being applied over it, the T bandage should be employed to retain them.

About twenty-four hours after the operation, the outward coverings should be removed, and an emollient poultice applied over the dressings ; and as soon as a free suppuration has taken place, the whole should be removed, and light easy dressings continued till the fores are healed, by a proper adhesion of the parts at the bottom of each.

A very important part of the cure is found to consist in the dressings being duly applied. Indeed, regular dressings are of such importance, that, without this attention, all the previous steps of the operation avail nothing. It is chiefly, indeed, by more attention being given to this in private practice, than can easily be done in hospitals, that we prove more successful with private patients in the treatment of fores of this description.

I have not yet mentioned the use of bougies, nor of the catheter, as a necessary part of the treatment subsequent to the operation ; and in this I shall possibly appear to be singular ; for we are commonly advised to keep a bougie constantly inserted from the time of the operation, excepting at the time of voiding urine, when a catheter is advised to be employed ; and in order to avoid the trouble of withdrawing the one, and inserting the other, some practitioners advise a flexible catheter to be kept in the urethra from the first.

The advantages supposed to accrue from the use of bougies here, is the prevention of any undue contraction of the urethra ; and by the catheter it is meant

to prevent the urine from passing off by the fore during the cure. These motives, for using both the one and the other, are plausible; and they have accordingly been generally adopted. I am free to confess, too, that, following the example of others, I have often employed both the catheter and bougie; but I cannot say that I ever did so with advantage, and I have often seen them do much harm. By distending the urethra, the sores do not so readily heal; and if the catheter does not pass fully into the bladder, part of the urine, in coming off, almost constantly passes between it and the urethra, so as to get access to the wound, by which it does more harm to the sore, than if no catheter had been used: and, again, if a catheter is passed entirely into the bladder, and kept long in this situation, it almost constantly does harm, by inducing pain, inflammation, and swelling about the neck of the bladder.

But whoever will go freely into a different practice, and will endeavour to cure this kind of sore without the aid of these instruments, will soon find that they are not necessary; and that the wound in the urethra, from the operation that I have described, is in general more easily cured, without the assistance either of bougies or catheters, than when they are employed; for instead of forwarding the cure of the sore, they uniformly tend to retard it, by tearing open such adhesions as nature, if left to herself, would have made altogether complete.

This, I must again remark, is a point of much importance, and merits all possible attention. The use of the bougie, in all such cases, is at present so universal, that the cure of a fistula in perinæo by an operation, is almost never attempted, but where bougies are at the same time employed; but, from much experience in this branch, I am now convinced that many more would be cured, if the bougie and catheter were both laid aside.

In real obstructions of the urethra, bougies, as I have said, are almost the only remedy to be trusted ; but they are of no farther use after these obstructions are destroyed : when, therefore, a fistulous opening remains after the obstructions are removed, or, when no stricture or obstruction exists, the operation that I have described ought alone to be depended on ; and in this part of the cure bougies ought never to be employed.

But it is said by those who patronise the use of the bougie and catheter, that if the urine is allowed to pass out by the fore, the cure will be thereby, if not altogether prevented, at least much retarded. To this it may be answered, that after the operation of lithotomy, we do not find the cure retarded although the urine comes at all times into immediate contact with, and during the first days after the operation passes constantly off by the wound. In what manner this is effected, I shall not at present determine ; but that the fact is so, no practitioner will deny : and from all the experience that I have had, openings in any other part of the urethra, require no more assistance from bougies or catheters, than they do in that part of it which is divided in lithotomy ; and every lithotomist, I believe, would spurn at the idea of keeping a catheter constantly in the bladder after this operation, in order to prevent the urine from passing off by the wound.

It happens, indeed, in a few cases of lithotomy, that a contracted state of the urethra is produced by the cicatrix of the fore : in this situation, after the parts are firmly united, bougies prove sometimes useful by removing the stricture ; and in particular instances, where the fore does not heal, by the urine continuing to pass by the wound, in consequence of strictures or adhesions in the urethra, the bougie is employed with advantage even during the progress of the cure. But these are rare occurrences, and no practitioner has ever recourse to bougies, till some degree of obstruction

has actually taken place : in the same manner they should never be employed in this operation, till the propriety of using them is pointed out by the formation of some degree of obstruction.

When the parts of which the perinæum is formed have become hard and otherwise diseased, before any operation such as I have described is advised, we are commonly directed to a long continued use of poultices ; mercurial frictions ; and the use of resolvent gum plasters. So far, however, as I have observed, little or no advantage is derived from this ; for any suppuration which it excites, is, in general partial, so that it has little effect in removing the hardness for which it was employed.

And, again, when the hardened parts are extensive, and when no relief is obtained from the discutient remedies that I have mentioned, we are in general advised to cut them entirely away with a scalpel. There is no necessity, however, for this measure ; for although it may be proper to remove the edges of the fores when they have become callous, there is never any good cause for extirpating all the diseased parts : it would frequently be a painful and cruel operation ; and as it could seldom be of any real advantage, it ought rarely, or never to be practised.

When, again, a preternatural opening is formed in the urethra, either by external violence or the abrasion of its substance by abscesses seated in it, a different course of treatment becomes necessary. When produced by an abscess in the perinæum, or in any part of the urethra, a free discharge should be given to the matter ; every part of the cellular substance in which it is found to lodge should be laid open ; and warm fomentations and poultices should be applied to such inflammatory tumors as have not suppurated. In this manner, fores, which if neglected, would prove highly distressful, are often made to heal easily ; but when even by these means the fores do not unite, and con-

tinue to discharge matter, and especially when their edges become hard and callous, the sinuses must be laid open, and every other part of the cure conducted in the manner that I have already advised.

This kind of fore when produced by wounds of the urethra, requires a similar method of cure. By the removal of extraneous matter, and by the use of poultices to abate inflammation, a cure will often be accomplished without any other assistance; but, when the state of the sores requires it, they ought to be laid open, and treated in every respect like other cases of fistula.

The most distressful variety of this kind of fore, is that in which the urine passes off directly from the body of the bladder without communicating with the urethra. This variety of the disease, I may remark, is readily distinguished from the other by the urine drilling off insensibly and at all times; whereas, when the external opening does not communicate directly with the bladder, and when the urine passes first through part of the urethra, the patient has commonly the power of retention in full perfection; by which his situation is much more comfortable than when the urine is constantly passing off. But although this variety of the disease is easily distinguished from the other, it is not so readily cured; for the sinuses from whence the urine is discharged communicate directly with the bladder, and nothing tends to remove them but laying them open to the bottom.

When, therefore, a patient distressed with this kind of fore, finds his situation to be such as to make the pain and risk of such an operation an eligible alternative, it ought certainly to be advised, as the only means from which any relief is ever likely to be derived.

As the intention and principle of this operation are the same as of that in which the urethra only is concerned, all that need be said in regard to the mode of performing it is, that a staff should be introduced into

the bladder ; the different sinuses should be laid freely open to the bottom ; their edges, if callous, should be removed to such a depth as can be done with safety, and the wounds thus produced should be lightly dressed, in the manner I have already pointed out.

In this manner, a great proportion of this variety of fore may be cured, provided the means are employed in due time, and duly persisted in : but in long continued fistulous fores of these parts, where the surrounding cellular membrane has become much hardened, and otherwise diseased ; and especially, when the system is tainted with scurvy, scrofula, or lues venerea ; it must be acknowledged that no means with which we are acquainted will prove at all times successful.

CHAPTER XXXIV.

OF HÆMORRHOIDS, OR PILES.

THE term hæmorrhoids, or piles, was at one time applied to every evacuation of blood from the veins running upon and in the neighbourhood of the rectum ; but a mere distention of these veins, when productive of pain, now receives the same denomination.

As long as the diseased parts of the veins remain distended, and do not discharge any part of their contents, the piles are named *cæcæ* or blind ; but when they burst and discharge blood, they are termed *apert* or open.

It frequently happens, that a discharge of blood upon going to stool is the first warning or appearance of this disease : for although in some instances it is otherwise, yet when the parts of the veins chiefly affected lie high in the rectum, the pain or uneasiness which they excite is for the most part inconsiderable, owing to the veins in this situation being surrounded with parts which from their softness readily yield to their distention ; whereas, when the disease occurs at the end of the gut, as the intestine is here surrounded with a firm muscular covering, the sphincter ani, a good deal of resistance is thereby given to the formation of hæmorrhoidal tumors, and they accordingly in this situation almost always excite a great deal of distress.

When piles are so situated as to be within view, if they have begun to discharge blood, one or more small openings are observed, from whence the blood is poured out : when the parts have not been previously much distended, these openings appear to be the mouths or outlets of veins ; and the openings from

whence the blood proceeds, are each of them observed to be seated upon a small protuberance arising from the internal coat of the gut. In general, these tumors, when they discharge freely, are small, being seldom larger than an ordinary pea; but when any obstruction occurs to the discharge of their contents, they gradually increase, till in some instances they arrive at the size of pigeons or pullets eggs, when by the pain, irritation, and tenesmus, which in such a state they always excite, much distress and misery are produced by them. Even when the tumors at last burst and discharge their contents, if they have previously become large, they do not disappear entirely: on the contrary, they still continue of nearly the same size; they assume a livid appearance; and instead of being soft or elastic, they are firm and of a fleshy consistence.

As long, however, as hæmorrhoidal tumors remain shut, they are soft and yielding to the touch, insomuch that by pressure they can commonly be much diminished; their colour is still more livid than that of the apert kind, and they are commonly more painful: for although they do not usually become large before bursting; yet when they lie deep, and are thickly covered with firm unyielding parts, the tumors are in some instances of such a size, as almost entirely to obstruct the passage of the fæces; and as a tenesmus is a common symptom in this state of piles, the distress produced by the frequent inclination to go to stool, together with the difficulty of the evacuation, never fail to induce a great deal of misery.

These tumors have commonly been supposed to proceed from a mere dilatation of the hæmorrhoidal veins. In the incipient state of the disease, while they remain small and circumscribed, this may frequently be the case; but whenever they become large, they will almost constantly be found to be connected with an effusion of blood into the contiguous cellular substance.

As long as piles remain small, soft, and compressible, we may conclude, that the blood still remains within the cavities of the veins; but whenever they become large, and of a firm fleshy consistence, the blood, as I have just observed, will, in almost every instance, be found effused into the neighbouring parts.

Various conjectures have taken place on the nature of the hæmorrhoidal discharge: but the most prevailing opinion is, that it is commonly of a critical nature; that it is induced by the presence of some peccant or morbid matter in the system; and that therefore it would, in general, be improper to put a stop to it.

It does not, however, require minute investigation to shew, that this reasoning is ill founded: for were we even to allow, that the piles commonly appear without the intervention of any evident occasional cause, and that they are in reality connected with some morbid humor in the blood, in what manner can we suppose this diseased matter to be separated and discharged by the hæmorrhoidal flux? Now that the circulation of the blood is well understood, it will be difficult for the supporters of this opinion to give a satisfactory answer to this question. But, independent of this, we know that piles are very commonly induced, perhaps in nineteen cases of twenty, by an obvious cause; and that the removal or prevention of this, when effected in due time, almost constantly prevents or cures the disease. In a great proportion of cases, piles will be found to proceed from compression upon the hæmorrhoidal veins; by which the blood contained in them being impeded in its progress to the heart, dilatations of these veins, and subsequent effusions, are consequences that necessarily ensue.

The most frequent causes of this compression are, large collections of hard fæces in the rectum; the pressure produced upon the neighbouring parts, in

pregnancy, by the gravid uterus; and lastly, tumors, of whatever nature they may be, which, from their situation, compress the hæmorrhoidal veins. Thus piles are not an unfrequent effect of schirrous tumors in the rectum, and of similar affections of the prostate gland and bladder; and I have sometimes traced them as the consequence of swellings in the mesenteric glands, which also act by obstructing the reflux vessels in their course from the rectum.

When tumors in the contiguous parts are found to produce the disease, the means of cure must be directed particularly to the removal of these. When pregnancy is the cause, gentle laxatives, and a frequent recumbent posture, will often afford relief; but nothing will remove the disease till delivery takes place. And, again, when piles have been induced by costiveness, a regular use of gentle aperients, such as cream of tartar and oil of castor, will very commonly procure relief. But when the parts inflame and become painful, such remedies must be employed as are known to be most powerful in removing, or even preventing the effects which these symptoms usually induce. If much fever prevails, blood should be discharged in proportion to the strength of the patient; and it answers best when taken by means of leeches applied as near as possible to the seat of the pain: nay, I often apply them upon one or more of the hæmorrhoidal tumors, and very commonly with much advantage: the pained parts should be frequently bathed with a mild solution of saccharum saturni; and the patient should be kept upon a low, cooling regimen.

I here think it proper to mention two remedies that I have often used with advantage in cases of piles. The one is an ointment composed of equal parts of oak galls finely powdered, and hogs lard or butter: this commonly gives more relief in external hæmorrhoidal swellings, than any of the sulphur ointments so frequently employed; and when the seat of the

pain is internal, and cannot be reached by an ointment, injections of a strong infusion of galls may be used instead of it. The other is a remedy that I first employed on the suggestion of our late justly celebrated professor Dr. Cullen; balsamum copaibæ. This medicine, given to the extent of fifty, sixty, or eighty drops, morning and evening, not only removes the pain so frequently produced by piles, but very commonly answers as an easy and certain laxative.

Warm emollient fomentations and poultices sometimes give relief in piles, but as they tend, when long continued, to excite relaxation in the contiguous parts, by which very large descents of the gut are produced, they should in every instance be soon laid aside.

By the use of one or other of these remedies, all the ordinary symptoms of piles will in general be removed: but there are some states of the disease that can only be relieved by a surgical operation; and these particularly are, frequent returns of profuse evacuations of blood from the hæmorrhoidal vessels, and the piles becoming so large as to induce much pain, irritation, and even obstruction in the under part of the rectum.

When frequent returns of hæmorrhagy have weakened the system too much; and when bloodletting, gentle aperients, and a proper regimen, do not prove effectual, our next resource is to put a stop to the discharge by the direct application of pressure to the mouths of the bleeding vessels. In slight cases of piles, this may frequently be done by a tube of silver wrapped properly round with soft linen, being passed into the rectum; or a piece of sheep's gut, tied at one extremity, being pushed into the anus, and a quantity of water or any other fluid being conveyed into the open end of it, which ought to be of a length to admit of two or three inches hanging out at the rectum, almost any necessary pressure may thus be applied, merely by

pushing the water into the upper part of the gut, and securing it there with a ligature.*

In various cases I have proved successful with this remedy, where others have failed, and in some instances I have derived advantage from cold astringent infusions and solutions being thrown into the rectum, such as infusions of red rose leaves, walnut-tree leaves, and oak bark, and solutions of alum, and even of saccharum saturni, and white vitriol. When these remedies do not succeed, there is often reason to think, either that the vessels from whence the blood is discharged lie too high in the abdomen to admit of their being acted upon in this manner, or if near the end of the gut, that they are of a considerable size : in the one case, we trust entirely to perseverance in the means that have already been mentioned ; particularly to the effect of a low regimen, gentle aperients, and the internal use of alum, kino, and other astringents ; while in the other, if the bleeding vessel can possibly be perceived, it ought at once to be secured with a ligature. To those who are not accustomed to the application of this remedy, it may appear to be of a hazardous nature, but when properly applied, I can, from much experience of the effects of it, venture to say, that it never does harm, while it seldom fails to act with certainty in the cure. The ligatures may be applied either with the crooked needle or tenaculum ; but the latter should perhaps in every instance be preferred, as with it the ruptured vessels alone can be tied without including any of the contiguous parts, which cannot be done when we employ the crooked needle.

I have already observed, that in some instances, the tumors produced by piles become very large. As long, however, as they are not painful, or very incon-

* Mr. Bromfield, when treating of the extraction of the stone in women, advises the urethra to be dilated by means of water contained in the gut of a fowl. In justice to Mr. Bromfield, I must observe, that the practice here recommended is taken from this hint.

venient, they ought not to be touched ; but whenever they become so large as to obstruct the passage of the fæces, they ought if possible to be removed : when situated near to the verge of the anus, this may commonly be easily done ; and even when an inch or more up the rectum, they may frequently be brought completely in view by pressure, similar to what is employed on going to stool.

Various methods have been in use for removing these tumors, namely, ligatures, excision, and even the potential and actual cauteries. Neither of the latter, however, should be ever employed ; so that the methods by ligature and excision are those that we have to consider.

When a hæmorrhoidal tumor is attached by a small root, and when therefore a ligature is easily applied, we are commonly advised to take it off in this manner ; and on the contrary, when it adheres to the gut by an extensive surface, we are desired to dissect it off with a scalpel. The very reverse, however, should be adopted ; for when the tumors are small, and attached by narrow necks, and when there is therefore no reason to be afraid of any hemorrhagy that may ensue from removing them by excision, as the scalpel may in this case be used with safety, it ought undoubtedly to be preferred, as the easiest and speediest method of finishing the operation ; but whenever they are large, and when there is reason therefore to suspect that the arterics that supply them with blood are large, the ligature ought certainly to be employed, as the only safe means of removing them. No good reason has ever been given for confining the use of the ligature to tumors with small necks ; for although in these it is more easily applied, yet with due care and attention, even such as have broad extensive attachments may be removed in this manner.

A needle armed with two firm waxed ligatures being introduced through the middle of the tumor at

its base, and the ends of one of them being firmly tied round one half of the tumor, whilst the other half of it is secured by the other ligature, the whole may in this manner be removed with as much certainty as when the base is narrow. If the ligatures have been properly applied, the tumor will commonly fall off in the space of three days : in some instances, they drop off in forty-eight hours, or even in less ; but in general three days are required. When the scalpel is employed for the removal of these tumors, the parts should be afterwards dressed with soft lint, covered with any emollient ointment ; but when taken off with ligatures, no dressing is necessary.

In the use of ligatures for this purpose, when more than one is contained in the same needle, their being of different colours tends to prevent confusion.

CHAPTER XXXV.

OF CONDYLOMATOUS EXCRESCENCES, AND SIMILAR AFFECTIONS ABOUT THE ANUS.

THE parts about the anus are liable to excrescences, termed condylomata, fici, and cristæ. The distinctions, however, which these names import, are of no moment; for these tumors are all of the same nature, and are cured by the same means.

We sometimes meet with them in the cavity of the gut itself; but most frequently they are confined to the parts exterior to the sphincter. They are of different degrees of hardness, being in some instances not much firmer than the parts with which they are connected, and in others they resemble the firmest schirrus. Their colour is also very various: in some they are of a pale white, and in others of different shades of red. In some instances, a single excrescence or two is only met with; but in others they cover almost the whole parts contiguous to the anus. In some, they never become larger than ordinary warts; and the disease, even in its most advanced stage, is found to consist of a number of these, either adhering together, or lying in close contact. But in others, the tumors are from the beginning broad and flat, being frequently of the shape and magnitude of split garden beans.

These excrescences, on their first formation, seem all to be productions of the cuticle; but when of long duration, they commonly adhere to the skin itself, and in some instances even proceed to the depth of the contiguous muscles.

As long as they create no uneasiness, they should never be touched; and it frequently happens that they never become so large as to require much attention;

while in some they excite so much distress, that we are obliged to remove them immediately.

In such as are soft, rubbing them from time to time with crude sal ammoniac, or washing them with a strong solution of that salt, or with spirit of hartshorn, will frequently remove them. The pulvis fabinæ, too, in fine powder, often answers the purpose, as well as red precipitate of mercury, particularly when mixed with equal parts or thereby of calcined alum; but all of these remedies are slow in their operation; and when the tumors are hard and warty, they have little or no effect. When they do not, therefore, succeed, we employ either the scalpel or lunar caustic: but when the patient will submit to the scalpel, it ought always to be preferred; for no danger can arise from it, as the parts to be removed are not supplied with large blood vessels. All the diseased parts should be completely removed; and dry lint being applied to the sores, they fall afterwards to be dressed like wounds produced in any other way.

When the fears of a patient, however, prevent him from submitting to this operation, caustic must necessarily be employed: but in the use of this remedy, much attention is necessary, to prevent it from spreading to the gut; for mischief might ensue were it to be directly applied to it.

CHAPTER XXXVI.

OF A PROLAPSUS ANI.

A PROTRUSION of any part of the rectum beyond its usual limits, is termed a prolapsus ani. In some instances, the displaced portion of gut is inconsiderable, but in others it falls down to a great length.

The sphincter ani and neighbouring parts, whilst in full strength, serve as a base or support to the superior part of the gut : whatever, therefore, tends to induce any morbid debility of these, will necessarily have some influence in the formation of a prolapsus ani.

The most common cause, however, of this protrusion of the gut is, frequent and violent exertions excited in the rectum itself by some irritating cause about its extremity ; thus producing what we commonly term tenesmus : a frequent use of aloëtics is said to be very apt to excite irritation in the rectum, although, from much observation, I am now inclined to doubt of the truth of it ; but I have much reason to think, that the small worms termed ascarides, by lodging chiefly in the under part of the rectum, and by thus producing irritation, have, in different instances, induced descents of the gut. Habitual costiveness, hæmorrhoidal swellings, and in short every cause that stimulates the rectum to over exertion, will also be apt to produce it.

The rectum often remains unreduced for a great length of time, and no bad consequences ensue : hence it is evident, that this portion of gut will bear more exposure to the air than the other parts of the intestines ; but we ought not from this to be ever induced to allow any part of it to remain long down, without attempting to reduce it. By many, we are desired, before reducing the gut, to foment it well with emollient and antiseptic decoctions ; and the operator is

directed to cover his fingers with oiled or waxed linen before any pressure is applied to it. These previous steps, however, are not necessary. We should instantly indeed endeavour to return the prolapsed parts, without allowing them to be exposed to such injuries as might ensue from the delay in fomenting them; and as we can handle the parts with more exactness when the fingers are bare, than when covered with oiled or waxed gloves, these ought never to be employed; but when any covering is judged to be necessary, a piece of soft oiled cotton cloth answers the purpose better than any other.

The patient being put into bed, and laid upon one side, or upon his face, which answers better, with his buttocks elevated above the rest of his body, the surgeon should now press firmly, though equally, with the palm of his hand upon the under part of the protruded gut. By a continuance of this kind of pressure, the gut is in general easily reduced; but when this does not succeed, we seldom fail by pushing up the superior part of the gut with the fingers, while the palm of the other is made to support the inferior part of it. When, indeed, the prolapsed portion of gut has previously become much inflamed and swelled, no means of reduction will succeed till these are removed. In this situation, therefore, before pressure is employed, it may be proper to discharge a quantity of blood in proportion to the strength of the patient, particularly with leeches, from the neighbourhood of the anus; the gut should be fomented with a weak solution of saccharum saturni, moderately warm; and when, by these means, the swelling is nearly, or perhaps entirely removed, the prolapsed parts will be easily reduced in the manner I have already advised.

We seldom, indeed, find it difficult to reduce protrusions of the rectum; but it is often no easy matter to retain them after they are replaced: for the sphincter ani, by repeated descents of the gut, often becomes so relaxed that it does not retain it; so that a protru-

sion takes place, not only on going to stool, but often on every attempt to walk, or to sit in an erect posture.

When the gut thus falls readily down, much benefit may be derived, from a proper bandage. On the protruded portion of gut being replaced, if a thick compress of linen is applied directly upon the anus, a proper application of the T bandage over the whole proves often useful. But in Plate LXXVII. fig. 3. I have delineated a truss originally invented for this purpose by the late Mr. Gooch,* by which the parts may be more completely retained than with any other bandage, while at the same time the patient may be allowed more freedom than he could otherwise possibly venture on.

The parts that protrude upon going to stool being immediately replaced, an operation that the patient himself can often accomplish, this truss should be directly applied; and with a view to strengthen the sphincter ani and neighbouring parts, the debility of which is often to be considered as the sole cause of the descent, the patient should be advised to the use of steel, bark, cold bathing, and dashing cold water upon the buttocks and under part of the back: considerable advantage has also been experienced, from a frequent use of astringent injections, particularly infusions of galls and oak bark; and when a small proportion of opium is added to the liquor, the irritability in the rectum, which is often to be considered as the original cause of the disease, is thereby more effectually removed than in any other way. I have sometimes ventured to add a small quantity of alum, and saccharum saturni, to these injections; but in general, any addition of a saline nature is here inadmissible, from the irritation that such remedies commonly give to the gut.

By one or other of these means, the disease may either be entirely cured, or at least so far palliated as to obviate every inconvenience from its continuance.

* Vide Cases and Practical Remarks in Surgery, &c. vol. II. by B. Gooch.

CHAPTER XXXVII.

OF AN IMPERFORATED ANUS.

AN imperforated anus is not an uncommon occurrence, so that every midwife should examine with attention the state of this and other natural passages immediately after birth.

In some, the end of the rectum is somewhat prominent where the anus ought to be, being only covered with skin and a small quantity of cellular membrane: but in others, no vestige of the rectum is perceived; and the skin retains its natural appearance, without being any where elevated between the scrotum and point of the coccyx.

In some, the rectum terminates within an inch of the ordinary seat of the anus; in others, it has reached no farther than the top of the sacrum. In some it has been known to terminate in the bladder; and in others, in the vagina.

When the assistance of a surgeon is required, as death must ensue if a proper vent be not obtained for the fæces, no time should be lost in deliberation. If the end of the gut is found to be covered with skin only, and if a protuberance is formed by the fæces pushing it forward, all that the surgeon can do, is with a scalpel or lancet to make an opening of a sufficient size; but when this kind of direction is not met with, more difficulty and danger is to be dreaded.

When the gut is deep, an incision of an inch in length should be made directly on the spot where the anus ought to be; and this should be continued with gradual and repeated strokes of the scalpel, in the direction that the rectum ought to take; not in a direct course through the axis of the pelvis; for in that di-

rection the vagina or bladder, or perhaps both, might be injured ; but backwards along the coccyx, where the risk of wounding any part of importance is less. The best director is the finger of the operator. The forefinger of one hand being inserted into the wound, and passed towards the coccyx, the surgeon, with the scalpel in the other, should dissect gradually in this direction, either till he meets with fæces, or till the scalpel has reached at least the full length of his finger ; and if, after all, the fæces are not reached, as death must ensue if more be not attempted, I would advise a long trocar to be pushed forward upon the finger, in such a direction as the operator thinks will most probably meet with the gut.

In this manner many lives have been saved which would otherwise have been lost. I myself have had two such cases ; in both of which the gut lay deep, and in both I was fortunate enough to form an anus, which for many years has continued to answer the purpose sufficiently. But in both it was exceedingly difficult to preserve the passage sufficiently wide : for as soon as the dossils of lint and other tents employed for preserving the passage were withdrawn, a very strong contraction took place, by which the opening was occasionally nearly obliterated. Sponge tent, gentian root, and other substances that swell by moisture, were at different times employed ; but these uniformly gave so much pain and irritation, that they could not be continued. They are commonly, indeed, recommended in such cases ; but all who have ever employed them in parts so exquisitely sensible as the rectum, will soon be convinced of the impropriety of the advice.

Dossils of soft lint moistened in oil, and rolls of bougie plaster of a proper size, were found to irritate less, and to answer better than any other application ; and for the purpose of dilating the passage, when, at different times during the cure, it was found to have be-

come too strait, the method I have already advised (when speaking of piles) of compressing blood vessels in the rectum by introducing a sheep's gut, shut at one end, into it, and forcing water up by the other, was employed with advantage. But upon the whole, although this part of the cure may appear to those who have not met with such cases, to be simple and easy, it is found to be much otherwise in practice. Indeed, no case in which I was ever concerned, gave so much perplexity and trouble, either to the patient or myself, as each of those I have mentioned; for although in both, the openings were at first made sufficiently large, yet nothing but continued attention for the space of eight or ten months, prevented the necessity of a frequent repetition of the operation. When the skin alone is to be cut, it is a simple matter indeed; for in this case nothing is in general necessary but the introduction of a dossil of soft lint for a few days into the opening. But when the rectum lies deep, I am inclined to think, from the event of those cases, that although ultimately, a complete cure may commonly be obtained after a free discharge of fæces is procured, that much care and attention on the part of the operator will always be required for a considerable time after the operation; and in general we may suppose, that the difficulty will be in proportion to the depth of the cut.

Even where the gut terminates in the bladder or vagina, the operation should be advised: for, as in the one case, all the fæces must be emptied into the bladder, there would be much risk of such accumulations being formed in it as would soon put a total stop to the discharge by the urethra; and in the latter, where the rectum terminates in the vagina, much distress would ensue from it, which a successful issue of this operation alone could prevent.

When it unfortunately happens that no passage is obtained for the fæces by any of the means that I have

mentioned, might not we attempt an opening above the pubes, with the view of reaching the under extremity of the colon, or perhaps on the right side, so as to reach the caput coli, for the purpose of making an artificial anus? It is true, that the chance of success from such a measure would not be great; and, even admitting that the attempt should succeed in the most complete manner, the discharge of fæces from the opening would always prove troublesome and very uncomfortable; but the melancholly idea of leaving a child in such a state, to die in much pain, must prove so highly distressful, both to the parents and operator, as would incline me rather to advise even the doubtful and desperate remedy I have mentioned.

CHAPTER XXXVIII.

OF THE FISTULA IN ANO.

EVERY sinuous ulcer in the neighbourhood of the rectum is termed a fistula in ano. This is the most accurate and most simple idea that can be given of the disease : for although, in different instances it assumes a variety of appearances, and although the descriptions given of these have tended to render this part of chirurgical pathology extremely perplexed, yet whoever will attentively consider all the circumstances that relate to it, will find, that the fistula in ano is of a nature as determined and fixed as any disease that falls within the province of surgery.

Several varieties of this ulcer are described by authors : an external opening contiguous to the anus, communicating with an internal ulcer, but without any connection with the rectum, is termed an incomplete fistula : when the ulcer has two outlets, one external, and the other opening into the gut, the fistula is said to be complete ; and again, when it communicates with the gut only, without any external opening, it is termed an internal or occult fistula.

This disease has been likewise distinguished into simple and compound. When the parts through which the sinus runs are hard and tumefied, or when a communication is discovered between the ulcer and the bladder, vagina, os sacrum, and other contiguous parts, the fistula is said to be of a complicated or compound nature ; and it is termed a simple fistula, when all the neighbouring parts are sound.

In the commencement of the disease, the contiguous parts are very commonly found ; but whenever the ulcer has been of long duration, not only the parts

about the anus, but even the perinæum and buttocks, frequently become diseased. This may depend on different causes, but it appears most frequently to proceed from the matter of the abscess or sinus not finding a proper vent, and from its being allowed therefore to spread along the contiguous cellular substance.

Thus, we sometimes find, that the perinæum and part of the buttocks have become hard, with various sinuses running in different parts of them; and when the matter is sharp and acrid, instances occur of the os sacrum becoming carious, and of the bladder and vagina being corroded so as to have the contents of the rectum emptied into them. This last stage of the disease is not, however, often met with; and it would probably never occur, if the disease were properly managed from the beginning, by a free discharge being given to the matter.

In enumerating the causes of this disease, it may be remarked, that whatever tends to produce matter about the anus, may be considered in this light. Thus the piles, condylomatus tumors in the neighbourhood of the rectum, hardened fæces collected in the extremity of the gut, and, in short, whatever can excite irritation and inflammation of these parts, will occasionally terminate in suppuration; and, if the matter thus produced be not absorbed, or if the sore arising from the bursting of the abscess, does not soon heal, a sinuous ulcer will very readily form. I may also remark, that abscesses in these parts frequently succeed to fevers and other diseases of the constitution.

The circulation being more languid here than in other parts, every inflammatory tumor that forms in it is not only more apt to suppurate, but the sores that ensue heal with difficulty. They always excite much distress, and require much caution and attention, in the treatment. We have it commonly in our power, however, with proper management from the first appearance of inflammation about the anus, to prevent

much of that pain and misery, that these tumors, when neglected, are ultimately sure to induce.

As soon as this kind of tumor has advanced so far as to make it probable that suppuration will ensue, every means that can accelerate the formation of matter should be advised: and as nothing answers this purpose with more certainty than a continued application of heat, warm emollient poultices, fomentations, and the steams of warm water, are chiefly to be trusted. By a due application of these remedies, the tumor may in general be made to suppurate quickly; and as soon as matter is formed, it ought to be discharged by a free incision in the most depending part of it.

In this stage of the disease, much more depends upon the abscess being freely and timously laid open, than is commonly imagined; for if this is long delayed, or if the opening is not made of a size sufficient for discharging all the matter, it is thus allowed to pass into the contiguous cellular substance, so as to separate, not only the skin but all the under part of the rectum, from the muscles and other parts with which they naturally lie in contact: and in this manner, instead of a simple sore, which, when the abscess is rightly treated, is all that we ought to meet with, the whole under part of the gut is in some instances entirely separated from the surrounding parts, and a variety of sinuses form in different directions, either along the perinæum, or by the side of the gut, and in some instances among the muscles of the hips.

With a view, therefore, to prevent these distressful consequences, as soon as an abscess in this situation is found to contain matter, it ought, as I have observed already, to be opened by a free incision; by which means, and with due attention to the subsequent treatment of the sore, if the constitution is otherwise sound, a speedy cure may in general be expected.

The matter being discharged, dossils of lint are commonly crammed into the sore, with a view to pre-

vent, as it is said, the parts which have been newly divided from adhering too soon. This, however, is a very erroneous practice: for extraneous substances of every kind, by the irritation that they give to the rectum, almost always do mischief; and, if the opening is of a sufficient size, there is no necessity for this precaution, as the constant discharge of matter from the fore, proves in general sufficient for preserving it of a size adequate to the quantity produced; and this I may remark is the principal object we have in view from the operation.

Instead of irritating the parts, therefore, by the introduction of doffils, as soon as the matter of the abscess has been freely discharged, the sore should be merely covered with soft lint spread with any mild ointment, and an emollient poultice applied over the whole.

Any hardness that did not disappear during the supuration, will thus be soon removed, and a cure will in general be quickly obtained.

It most frequently, however, happens, that the aid of surgery is not desired in this first and very simple state of the disease; nor till the abscess has burst of itself, and perhaps at an improper part; and till of course much mischief is produced, by the matter having insinuated into the surrounding cellular substance: in this situation, one or more sinuses are commonly met with, forming, according to their duration different degrees or stages of the real fistula in ano.

When, in this state of the disease, the advice of a practitioner is desired, the first object he should have in view, is to discover with accuracy the course of the sinuses; for nothing can with propriety be done till this is accomplished. When the sinuses discharge their contents by external openings, the direction in which they run is for the most part easily discovered: if they run along the perinæum, or spread among the muscles of the hips, a probe, introduced

in the usual manner will readily pass along the whole of them : but when any of the sinuses follow the direction of the gut, the forefinger of one hand, after being well oiled, should be introduced into the rectum, at the same time that the probe is entered at the wound with the other : by this means we not only prevent the gut from being much injured by the probe, but if any communication has taken place between the gut and the sinus, it is in this manner easily discovered, by the point of the probe passing from the sinus, and being found in the gut with the finger. In a few cases, however, even when we know that the sinus communicates with the gut, the probe does not pass easily from one to the other ; but with due perseverance we always succeed ; and if the probe is rightly managed, it may always be done without risk of hurting the gut.

As our knowing with certainty, whether the sinus communicates with the gut or not, is of much importance in the cure, nothing should be omitted that may enable us to determine the point with precision. When air or fæces are discharged by the sinus, or when water or any other fluid injected into it is returned by the anus, the existence of such a communication cannot be questioned.

The absence, however, of these tests, does not imply that no communication takes place between the gut and the sinus : for we know that the passage of fæces from the rectum into sores of this description, does not always happen ; and we may easily suppose it possible for an opening between the sinus and the gut, to be so formed as to prevent the passage of liquids from one to the other.

When, by a repetition of cautious trials with the probe, or with injections of warm water into the sores, the course of the different sinuses is discovered, the method of cure is next to be determined. In a preceding part of this work, the method of curing sinu-

ses has been pointed out :* but from the nature and situation of the parts in which this variety of the disease is seated, some peculiarities occur in regard to the cure.

Astringent injections, pastes and ointments of the same nature, have at different times been recommended for putting a stop to the discharge of these sinuses. But the caustic property of these remedies is by no means suited to the irritability of the parts in which this disease is seated ; nor have they by experience been found to answer the intention for which they were proposed : they have now, therefore, very universally fallen into discredit.

I have elsewhere shown, that the leading object to be kept in view in the treatment of sinuses, is the destruction or annihilation of the cavities from whence the matter is discharged. With a view to this, different means have been advised. Where pressure can be employed, the sides of sinuses are, in some instances made to adhere by means of it ; but in the fistula in ano, this method of cure is inadmissible, as in this situation no regular or equal pressure can be applied.

This being the case, and knowing that adhesion readily takes place between contiguous parts in a state of inflammation, we endeavour to make those parts inflame that we wish to adhere to each other. It is perhaps indeed a doubtful point, whether animal substances can be made to adhere permanently by any other means than through the intervention of inflammation.

For the purpose of exciting this inflammatory or adhesive state of a sinus, so necessary for the reunion of its sides, different means may be employed. It may be accomplished either by the introduction of a cord of cotton or silk along the course of the fore, or by laying the sinus open through its whole length, so as to convert it as nearly as possible into the state of a recent wound.

* Vide Chapter V. Section V.

In other parts of the body, I have advised the use of a cord, or seton as it is termed, in preference to every other method of cure; as by means of it, we have it in our power to excite almost any degree of inflammation, without any of the disadvantages that sometimes ensue from the extensive cicatrix of a large wound. In the fistula in ano, however, the seton cannot be employed; for the irritation that it would excite, would prove too severe a stimulus for the rectum, with which it would at all times be in immediate contact.

As in this situation, therefore, astringent and escharotic injections and pastes cannot be employed with safety, as pressure is inadmissible, and as cords of even the softest materials would excite a very insupportable degree of irritation; we are under the necessity of employing the only other remedy by which a due degree of inflammation can be induced, namely, a free and extensive incision along the whole course of the sinus, commencing at one end of it, and terminating at the other.

Having thus endeavoured to ascertain the proper method of cure, we shall now proceed to describe the easiest and most effectual manner of putting it in practice.

The course of the different sinuses having been discovered by a previous search in the manner I have advised, as it is of importance to have the alimentary canal, and particularly the rectum, emptied, a purge should be given on the preceding day, and a glyster an hour or two before the operation.

The operation is often done while the patient stands with his back to a clear light; but it answers better to place him upon a table, in the same manner as is done for the operation of lithotomy, with his legs bent and kept asunder by an assistant on each side.

The patient being firmly secured in this situation, the surgeon, after dipping the forefinger of his left hand in oil, should pass it as far as it will reach into the

rectum : with his right hand, he must now enter the point of the probe pointed bistoury, at the external opening of the fore ; and having passed it along the whole length of the sinus, till he feels the point of it through the opening in the gut, upon his finger in the anus ; (for I am here supposing that a communication takes place between the sinus and the rectum ;) he is now to push the point of it in upon his finger ; by means of which, he not only protects the opposite side of the gut, but by thus directing the point of the instrument, he cuts steadily, and the sinus is in this manner laid open with much ease from one end to the other. This being done, if any other external openings are perceived, the finger should be again passed into the rectum, and every fore that is met with should be laid open in the same manner. The bistoury to which I allude is delineated in Plate LXIV. fig. 2. and 4.

By many it is supposed, that every external opening that occurs here, communicates with a separate and distinct sinus ; and some have gone so far as to say, that these again are commonly found to communicate by separate openings with the gut. This, however, is seldom or never the case ; for I have very universally found, that all the external sinuses communicate with one common fore or abscess, and that this, in a great proportion of cases, perhaps in ninety-nine of every hundred, communicates with the rectum by one aperture only : and at any rate, the means to be employed, are in both cases the same. Whether the external or internal openings communicate with one or with more abscesses, they should be laid freely open from one end to the other.

In almost every instance, however, we find, that when the principal sinus is laid open through its whole course, from the entrance of the knife to the aperture in the rectum, the others are found to run no farther than into some part of the fore, without communicat-

ing directly with the gut ; so that their entire division is easily and quickly accomplished.

I have desired, in searching for the different sinuses, that this part of the operation may be accurately done ; so that it may be known with certainty, whether the fores communicate with the gut or not : if a communication is discovered, the knife should enter by this opening from the sinus into the gut ; for the opening is commonly at the most superior point of the sinus, and it is likewise proper that the knife should be made to pass in such a direction that the aperture into the gut may form a part of the incision : for if this should not be done, little or no advantage might be derived from the operation ; the parts would not readily adhere at this point ; and the fæces getting access to the cellular substance behind the gut, would be apt to give rise to a new collection of matter.

It frequently happens, however, that no direct communication can be discovered between the sinus and rectum ; in which case the fistula, as I have already remarked, is said to be incomplete : but in the method of cure, the treatment is nearly the same as when such a communication takes place ; only with this difference, that in the latter, the point of the bistoury passes into the gut at the aperture found in it ; whereas, in the other, an opening must be made in it at the superior part of the sinus, by pushing the point of the bistoury against the finger in the rectum ; and this being done, the operation is to be finished in the manner I have mentioned, by drawing the point of the instrument out at the anus, so as to divide the sinus through its whole length.

In the course of this operation, the sphincter ani is always divided if the fistula penetrates to any considerable height in the rectum : but this is not of such importance as at first sight might be imagined ; for although some degree of inability to retain the fæces frequently ensues for a short while after the operation, yet experience shows that the parts in general recover

their tone very completely, inſomuch that want of retention is ſcarcely ever at laſt mentioned by the patient, as any of the inconveniencies that enſue from it.

Various instruments have been propoſed for effecting this operation ; but none of them anſwer the purpoſe with ſo much eaſe and ſafety as the probe pointed biſtouri. A razor, with a probe point, Plate XCI. fig. 1. may be uſed in nearly the ſame manner ; but the biſtouri is poſſeſſed of all the advantages attending the razor, and as it can be directed with more ſteadineſs, it ought to be preferred.

Some have objected to this mode of operating, that in the caſe of an incomplete fiſtula, the point of the biſtouri, on being pushed through the gut will be apt to hurt the finger in the rectum ; and likewiſe, that it can never be applicable where the ſinus runs farther up the rectum than the finger can reach ; and with a view to obviate theſe inconveniencies, different instruments have been propoſed, particularly a director and ſcalpel.

The director, which ought to be large, being paſſed into the rectum, the ſinus or fiſtula is adviſed to be laid open through its whole length, by a ſcalpel being made to run along the whole courſe of it from the external opening of the ſinus. This, I muſt obſerve however, is a practice not to be imitated : the hazard attending it is evidently indeed ſo great, that it has ſeldom been attempted, nor will it probably be ever recommended but by ſuch writers as copy from one another. The parts chiefly affected by the operation, lie ſo contiguous to organs that ought not to be injured, particularly to the bladder, that we ſhould never on any account attempt to lay ſinuſes in this ſituation open, unleſs the finger is previously introduced to ſerve as a guide for the biſtouri ; and for the ſame reaſon the instrument ſhould never be carried farther than the length of the finger. Fiſtulous ſores do not commonly penetrate deeper here than the length of the forefinger : in ſome caſes, however, they go to a

greater depth : they have even been found to pass to the very superior part of the os sacrum, and across the pelvis in a direction between the rectum and bladder. In every such instance, however, all that an operator should attempt, is to lay the under part of the fore completely open, so as to procure as free and easy a discharge to the matter as possible ; for any advantage to be derived from the incision being carried to a greater depth than the finger can reach, would seldom if ever compensate the hazard of the attempt : and whenever the sinuses are confined to the under part of the gut, no other director than the finger is required ; for whoever has done the operation in the manner I have advised, will find that the rectum is easily pierced with the probe pointed bistoury, and that it may be done without hurting the finger previously passed into the gut.

It is alleged by some, that danger may occur from sinuses in this situation being cut freely open : troublesome hæmorrhagies, they think, may happen, from the hæmorrhoidal arteries and veins being cut ; so that it has been proposed to open the sinuses with ligatures : by inserting one end of a piece of pliable silver or lead along the course of a sinus, pushing it into the rectum, drawing it out at the anus, and twisting the ends of it together, the contained parts are thus directed to be gradually compressed and divided. But this being not only more painful, but also more tedious, than the method of dividing these parts with a bistoury, and as we have few instances of the hæmorrhagy that ensues from this operation being severe, the latter is very universally preferred : the late Mr. Dessault of Paris, a surgeon of much eminence and respectability, conceived, indeed, a partiality for the method of curing this disease with a ligature, formed of lead or silver wire, and he contrived a very ingenious apparatus for passing the lead ; but for the reasons that I have given, there is no reason to suppose that it will ever be much employed by others.

The different sinuses being laid open with the bistoury, much care is required in applying the dressings, for on this the success of the operation in a great measure depends. Some, however, are so inattentive to this, as to suppose that every thing necessary is done, when the division of the parts is completed ; but this is so far from being the case, that I may freely assert, that a cure will seldom be obtained, if much attention be not given to the subsequent treatment of the sores.

The parts, however, ought not to be much crammed with dressings ; nor should any thing be employed that is not perfectly mild, and incapable of exciting much irritation. Dry lint is almost the only application that practitioners use, but it is ill suited for the purpose. One of the most distressful symptoms that ensues to this operation, is diarrhœa, attended with tenesmus, or a frequent desire to go to stool. In some, the division of the sinuses alone appear to excite this ; but it very commonly may be traced as a consequence of the after management of the sores : for every application that is not perfectly mild, and especially if forcibly pushed to the bottom of the wound, is sure to induce a very distressful degree of irritation in the end of the gut ; and as this almost always excites a frequent discharge of fæces, that not only tends to reduce the strength of the patient, but to interrupt the cure of the sores, it becomes highly necessary to avoid it.

With this view, instead of dry lint, I have long been in the practice of using fine thin old linen dipped in oil or spread with any simple mild ointment ; by which we with certainty avoid that distressful irritation which dry applications to such sores never fail to induce. After the wounds, therefore, have been cleared, a very small pledget of this kind of linen, thinly covered with simple liniment of wax and oil, should with the end of a probe be gently inserted between their edges ; but not to such a depth, or with such force, as to give any

kind of uneasiness. This being done, and a cushion of fine tow, covered with a compress of soft linen, being applied over the parts, and secured with a T bandage, the patient should be carried to bed; and the dressings being renewed, either after every stool, or, when these are not frequent, once in the twenty-four hours, the sore will in general fill up from the bottom, and will at last cicatrize in the same manner as wounds in any other part. This kind of sore should indeed be managed in every respect like similar sores in other parts of the body: for although something mysterious or peculiar has commonly been supposed to exist in sores about the anus; yet this is by no means the case: they are of a nature exactly similar to sores in other parts, and are to be cured at all times by the same means. They should be lightly and easily dressed, in the manner I have advised. No injections should be used, as is often done with a view to cleanse the parts. They are not more necessary here than in any other sore, and I have constantly seen that they do harm. They not only irritate and inflame the parts to which they are applied, but if used with much force, the liquor is apt to find its way into the contiguous cellular substance, and in this manner to form new sinuses. They should in no instance therefore be employed.

I have already observed, that, by perseverance in this mild course of treatment, a cure will, in general, be obtained. But in some instances it is otherwise; and instead of a good discharge, and red fresh granulations, with which the wound in a healing state ought to be covered, the parts become soft, flabby, and unhealthy, and the matter is thin, fetid, and perhaps mixed with blood. If, on a minute inspection of the sore, any part of a sinus is found to have escaped notice, and if matter is found to lodge in it, a certain and almost immediate advantage will be derived from laying it open to the bottom. The most frequent cause of failure indeed in this operation is want of attention to

this very necessary point ; in the first place, by due pains not being taken to discover the sinuses in the time of the operation, and a desire afterwards to perform the cure by any other means rather than put the patient to the pain of another operation, or candidly to avow our own error, which in every instance should freely be done. I readily own, that when I first settled in business, I fell into this error, in different instances : by not searching with sufficient pains after the first incision was made, sinuses escaped notice that might have been discovered : but having long been convinced, that a patient had better be kept much longer on the table, so as to have all the parts examined in the most accurate manner, than to incur the risk of a second operation, I now spend so much time upon this, that in the course of these eighteen or twenty years, scarcely an instance has occurred with me, out of some hundred cases, of the operation being from this cause to be repeated : I own, however, that more time is for this purpose spent on the operation than is commonly done.

It sometimes, again, happens, that the cure of the fore is retarded, not by any fault in the operation, but by real disease of the system : in this case, if the patient is found to labour under lues venerea, scrofula, or scurvy, the remedies appropriated to the existing disease should be prescribed ; or if the constitution is merely relaxed or weakened, whether by fever or any other cause, the natural tone of the system should be restored, by a nourishing diet, a proper allowance of wine, and residence in good air.

When treating of ulcers in Chapter V. I have endeavoured to inculcate the utility of issues in every variety of fore ; but in no variety of the disease does this remedy act with more advantage than in the fistula in ano, especially when the discharge has been of long duration. Different instances, indeed, have occurred to me, in which, where issues are not inserted, the patient was obviously injured by curing the disease : other dis-

eases of a more alarming nature were induced by it ; while in some I have not been able to obtain a permanent cure of the sinus till an issue was inserted : I am now therefore so much convinced of the utility of issues, that whenever the disease has been of long duration, and the discharge copious, I seldom advise the operation till an issue is inserted.

Hitherto, I have been supposing, that the disease has not advanced farther than to produce sinuses along the course of the rectum, and parts immediately contiguous. We shall now proceed to consider it in its more advanced stages.

The first of these that I shall notice, is that in which the parts lying contiguous to the sores, have been separated or detached from each other, by a mere effusion of matter into the surrounding cellular substance. This, to a certain degree, is the case in every sinus ; but when sinuses about the anus have been of long duration, the matter which they produce, if it does not find a free outlet, spreads in some instances so extensively among the contiguous parts, as to separate, not only all the skin and other teguments from the muscles underneath, but to detach all the under part of the rectum from the cellular substance with which, in a state of health, it is firmly connected. Of this I have now met with various instances.

In this state of the disease, two modes of operating have been advised ; either to take away a considerable portion of the teguments, so as to give free vent to the matter ; or, if this does not prove successful, to extirpate all the inferior part of the rectum that is found to be separated from the contiguous parts.

These operations, however, not only give severe temporary pain, but much subsequent distress ; and as all the advantages that arise from them may be attained in a more easy manner, they ought undoubtedly to be laid aside. To take away any large portion of the teguments about the anus, must of itself be extremely painful ; and to extirpate the extremity of

the rectum, would, in a great proportion of cases, be productive of more misery than could ever be induced by a continuance of the disease ; for, besides the difficulty and pain that in this situation would arise from the passage of hard fæces, it would be impossible for the patient to retain liquid stools.

This distressful operation, however, need never be put in practice ; for I know from various trials, that a simple division of the gut will with more certainty accomplish a cure : all that ought to be done therefore is, to lay the detached portion of gut open from one end to the other in the manner I have already pointed out in cases of simple sinus : and if this does not allow the gut to apply equally to the contiguous parts, another incision should be made on the opposite side of it ; by which means all such parts of it as were separated or detached from the surrounding muscles will now be equally applied to them ; no part of it will be puckered or unequal ; and if the neighbouring bones and other parts are sound, and the constitution not diseased, a cure will soon be obtained by adhesion again taking place between the gut and parts that lie behind it.

Upon the same principles that in this situation we advise a division of the rectum, when the matter has passed between the skin and muscles of the perinæum, or of the hips, the bag in which it is contained should be freely laid open from one end to the other ; and if one incision is not sufficient, another should be made without delay : the same dressings should be applied here that I have already advised where the sinus runs behind the rectum.

Hitherto I have supposed that the fistula or sinus discharges its contents by one or more external openings in the neighbourhood of the anus : this, however, does not always happen ; and the matter, instead of being discharged by an external opening, is in some instances, first emptied into the gut, and afterwards discharged, either by itself, or mixed with fæces on the

patient going to stool. This, as I have already observed, forms what has been termed an occult fistula, or, according to French authors, *une fistule borgne*.

As the usual and most certain characteristic of fistula, namely, an external opening discharging matter, is here wanting, some attention is required to ascertain its existence, as well as to prevent it from being confounded with other diseases. Thus, matter discharged from abscesses in the upper part of the alimentary canal, has, in some instances, been supposed to proceed from an occult fistula in the neighbourhood of the anus; and vice versâ, pus collected in and discharged from an imposthume near to the anus, has, merely from want of attention, been supposed to originate from disease in the upper part of the gut; and upon this supposition, remedies have been prescribed without effect, when a complete cure might have been obtained by very simple means.

The distinction, however, between these diseases is, in general, sufficiently evident. When matter collected in the superior part of the gut, is at last discharged by stool, it is commonly thoroughly mixed with, and seems to constitute a part of, the *fæces*, and no pain takes place near to the anus. But in the case of an occult fistula, the matter discharged by stool is not mixed with the *fæces*; on the contrary, they always appear distinct and separate; on minute investigation, some degree of hardness, swelling, or discoloration, is always discovered near to the fundament; and in this spot a considerable degree of pain is felt on pressure.

Various means have been proposed in cases of occult fistula, for discovering the site of the abscess. By some we are advised to pass a curved probe up the rectum; and to search with the point of it till the opening is discovered, when by pushing it forward, it may pass into the abscess:* others, again, advise a thick firm tent to be pushed into the rectum, so as to

* Vide Dionis—Course of Operations, Demonstr. iv.

obstruct every means of communication between the sinus and gut; and by this they suppose, that the matter of the abscess may be made to collect in such quantities as evidently to point out its situation. Neither of these methods, however, are necessary, nor is it probable that they would often succeed.

Whenever an abscess is seated near to the verge of the anus, however small it may be, it may be easily discovered: for, some degree of hardness, a small tumefaction, and most frequently some discoloration, is observed at some part contiguous to the extremity of the gut; and whenever this mark is perceived, and especially if pressure excites much pain, there will be no cause to doubt of this being the seat of the abscess.

In such circumstances, what are we to do? We ought here to have the same object in view, as if the matter had been discharged by an external opening: for the disease is in reality the same, and differs only in this single circumstance from the most frequent variety of fistula, that the matter is in this case first thrown into the rectum, before it can be discharged, instead of coming freely off by one or more external outlets near to the anus. And as the two varieties of the disease are very nearly the same, so the means necessary for their removal are very similar.

As soon as we have determined to perform the operation, the point of a lancet should be plunged into the tumefied or discoloured spot; and upon the point of the instrument reaching the abscess, which is at once known by a discharge of pus taking place, as the disease is thus reduced to the state of a simple, complete fistula, the operation is to be finished in the same manner as I have already advised for that variety of the disease; by the introduction of the finger of the left hand into the anus, passing the probe pointed bistoury in at the wound newly made, and on its point being discovered by the finger in the rectum, by drawing it out in such a manner as to divide the abscess or

finus through its whole length ; and the subsequent treatment of the sore is also the same as in other cases of fistula.

All that has been as yet said relates to the mildest and most simple stages of fistula ; the parts chiefly affected being supposed to be in no other way diseased, than by having an abscess seated in them, either occult, or with one or more external sinuses running into it. But when by neglect, or improper treatment, the matter collected in such abscesses does not find a free vent, the contiguous parts inflame, become painful, and in a gradual manner acquire much morbid hardness or callosity.

In such circumstances, various remedies have been advised : as a previous step to any operation, it has been proposed by some to dissolve this hardness or callosity, by the use of mercury, aided by suppurative or emollient poultices. Others advise the hardened parts to be destroyed with caustic ; but the opinion that has till of late most generally prevailed, is, that all the callous parts should be extirpated with the scalpel.

But whoever has had opportunities of becoming acquainted with this branch of practice, will know, that it is perfectly impossible to dissolve or dissipate any callosity that has been of long duration, either by poultices, mercurials, or other discutients ; and it luckily happens, that a cure may in general be obtained by means of a more gentle nature than the destruction of the hardened parts, whether by caustic or extirpation : when the parts cannot be preserved but at the hazard of the patient's life, they ought undoubtedly to be removed ; but as necessity alone should point out the propriety of such a painful and violent measure, it should never be advised when our views can be accomplished in a milder manner.

I have endeavoured to shew, and indeed the fact is obvious to all who will be at the trouble of observing, that the callous state of the parts that often takes place where the disease has been of long duration, is uni-

formly the effect of the matter not finding a free vent, and of its being thereby forced to disperse among the contiguous muscles; by which, pain, inflammation, and hardness, are successively and necessarily produced.

If this is a true state of the matter, and all practitioners of experience will probably admit that it is so, it must be obvious, that there can be no need of such violent remedies as those I have mentioned, namely, the removal of the diseased parts either with caustic or the scalpel: the means of relief to be employed here, are merely such as will afford a free outlet to the matter, whilst they also serve to induce and preserve a discharge of matter in the substance of the diseased parts, and which I am inclined to consider as the most effectual method hitherto discovered for the removal of all such morbid callosities.

Through the whole of this chapter, I have avoided the use of the word *schirrus*; and I am here particularly anxious to have it remarked, that I have done so: for in real *schirrus*, the remedy I have now pointed out, namely, the excitement of suppuration in the substance of the diseased parts, would probably prove highly pernicious, by forcing quickly forward to a state of cancer, a tumor, which, if left to itself, might probably have remained indolent for a great length of time. It is therefore evident, that an accurate distinction between real *schirrus*, and other hard tumors, is a point of much moment. Every hard tumor that from experience is known to be apt to degenerate into cancer, I would denominate *schirrus*. Now, we know very well, that cancers rarely attack tumors that are not glandular: so that to every indurated swelling of the cellular substance, and other soft parts not evidently glandular, a different appellation should be given: all of these may, with propriety enough, be denominated callous tumors.

Those hard tumefactions, therefore, seated in the cellular substance near the anus, as they never appear

to degenerate into cancer, I have termed callosities : the most effectual remedy that I have tried for the removal of these, is a free suppuration induced in them ; and the best method of effecting this, is by laying every sinus that can be discovered, freely open from one end to the other ; and when the sinuses are not numerous, it proves even useful to make one, two, or more deep incisions along the whole extent of the induration. By carrying the incision to the full depth of the indurations, such a plentiful flow of matter ensues to the inflammation that they induce at first, as commonly acts with much advantage in the cure.

Indeed none can imagine how highly beneficial this practice proves, but those who have experienced the benefit that ensues from it : in various instances, I have known it succeed completely where the total removal of the diseased parts had previously been judged to be indispensable. Where the disease has been of long duration, the remedy must indeed be long persisted in ; that is, a plentiful discharge of pus must be long preserved, either in the incisions first made, or, if these heal too quickly, in others made to succeed them.

In some instances, these incisions do not easily suppurate ; their edges inflame, become painful, and discharge a thin fetid matter. When this proceeds from lues venerea, or any other disease of the constitution, this must be first removed, before the incisions will yield good matter. But when the system is otherwise healthy, and when there is therefore reason to imagine that the untoward state of the sores proceeds merely from irritation, or some other local affection, in such circumstances, warm poultices prove highly useful : by their emollient properties, they tend to remove irritation with more effect than any other remedy ; and I have elsewhere shewn, that nothing acts with such certainty in the formation of good pus.

In every case, therefore, of fistula, attended with much hardness and tumefaction of the contiguous

parts, instead of removing the hardened parts either with caustic or the knife, the practice I would advise is this: the sinus or fistula should be treated in the same manner as if no hardness existed; that is, it should be laid freely open from one end to the other: if more sinuses are discovered, these should also be laid open; and if the hardness in the contiguous parts extends either laterally, or in any other direction beyond the course of the sinuses, one or more deep incisions should be made along the whole length of it: and by preserving these incisions in a suppurative state till the hardness is dissolved, they may then be allowed to heal from the bottom in the same manner with wounds or ulcers induced by any other cause.

By this management alone, when the constitution is otherwise healthy, the very worst variety of fistula may be cured with more certainty, and with much more comfort to the patient, than by the extirpation of the hardened parts. Indeed, scarcely any case, I think, can occur, of the parts being in such a state as to render it proper to remove them, if they have not been long and almost entirely separated from the subjacent muscles, with which, in a healthy state, they ought to be connected. This, again, can never take place, but from very gross mismanagement: when we do, however, meet with it, and when the hardened parts are so much detached from the others, that they would not probably adhere again, necessity points out the propriety of cutting them off; and in external ulcerations of these parts, when the edges of the sores have become hard and reversed, the cure may be promoted by removing the diseased parts; but in no other instance ought this practice to be attempted; for all the advantages said to be derived from it, may be obtained with much more ease and safety from the method of cure I have here pointed out.

The only other symptoms connected with fistula in ano, to which I have not yet adverted, are such as

arise from affections of deep seated parts ; namely, such as proceed from disease of the os coccyx, os sacrum, bladder, and parts about the loins.

It sometimes happens, that the matter collected in fistulous sores about the anus, by being allowed to spread among the neighbouring parts, comes at last even to injure the bones themselves ; but instances likewise occur of diseases of the bones being the primary affection, and of its giving rise to, instead of being produced by, sinuses about the rectum. Thus, collections of matter on the psoæ muscles, originating in some instances, from caries of the lumbar vertebræ, instead of falling down and pointing, as they commonly do, in the upper and forepart of the thigh, are sometimes found to follow the course of the intestines, and to discharge their contents at the side of the rectum. A severe bruise, too, upon the hips and contiguous parts, by injuring the os coccyx, has in some instances produced the same effect.

But the most distressful circumstance that ever accompanies fistula in ano, is the formation of a passage between the rectum and bladder. This sometimes happens indeed, where no sinus or abscess had previously appeared about the anus ; but it more frequently succeeds to ulceration in these parts, and by these being improperly treated, than to any other cause. The symptoms by which the existence of this dreadful malady is with most certainty known, are, in the first place, an unusual, dark brown, thick sediment, being observed in the urine, which by degrees becomes of a darker colour, and of a more offensive fæcal smell ; air is frequently discharged in considerable quantities by the urethra, both before and after voiding urine ; and in the latter stages of the disease, the urine does not get a free vent from the bladder.

The existence of these symptoms, serves sufficiently to ascertain the nature of the disease ; but hitherto we have not been able to discover any means of removing

it. So that all who have yet been attacked with it have at last fallen victims, after dragging on, twelve, eighteen months, or perhaps a few years of a miserable existence.

In the event of any of the bones of the coccyx, sacrum, or lumbar vertebræ, becoming carious, from the matter in this disease having been allowed to penetrate and to corrode them, all that art can do is to preserve a free vent for the discharge; to keep the parts clean; to extract any pieces of loose bone that may be discovered; and to strengthen the constitution by a nourishing regimen, with a view to enable it to support the long continued discharge to which it may probably be exposed: some few have in such circumstances, and with such a plan of management, been fortunate enough to obtain cures, by such pieces of bone as were spoiled being at last thrown off, and by the parts being then induced to heal. This, it must be confessed, however, is a rare occurrence; and all that, in this situation, we have reason to expect, is to be able to palliate the most distressful symptoms.

I have thus concluded what it was my intention to offer on the fistula in ano; and as it is a very distressful as well as a frequent disease, and especially as it was never till of late described with accuracy, I have hence been induced to consider it more minutely than I otherwise should have done. What I have endeavoured to shew, and to which I still wish to excite the attention of the younger part of the profession, is, that a sinus or fistula, is a disease of the very same nature in the neighbourhood of the anus, as in any other part of the body; and therefore, that the method of cure ought to proceed upon the same principles here as in similar affections of other parts. Till the late improvements made in the treatment of this disease, and till the true nature of it was understood, much confusion subsisted in the method of conducting the cure. Except in the most trifling cases of superficial sinuses, it

was never imagined that a simple incision could answer: nothing less than a total destruction or removal of the diseased parts was supposed to be sufficient.

But it will now, I hope, appear, that this is very rarely necessary; and when a cure is practicable, that it will be more readily accomplished by the means I have pointed out, namely, by a mere division of the sinuses, than by any other that has yet been proposed. It will sometimes happen, indeed, that, in cases of an inveterate nature, none of the means that I have mentioned will succeed; but, in all such cases, no advantage would be derived from more violent remedies, and much distress would certainly be induced by them.

I have already observed, that the best form of knife that I have yet seen for fistula in ano, is one or other of the bistouries, delineated in Plate LXIV. Those who are not accustomed to use this bistoury, are apt indeed to suppose, that it cannot penetrate the rectum but with much risk of injury to the finger of the operator, previously passed into the gut; but this is so far from being the case, that in none of the cases in which I have operated, and they now amount to some hundreds, has my finger ever been hurt: with a view, however, to obviate this difficulty, a very neat and simple invention has for some years past been used by many, and of which I have given a figure in Plate CXIV. fig. 2. and 3. and the mode of applying it will be seen in the explanation of the Plate. The probe pointed bistoury, however, when properly formed, divides the gut in a great proportion of cases with perfect ease, and with no hazard, as I have endeavoured to shew either to the patient or operator; but where the parts meant to be cut are of considerable thickness, as is the case when the sinus does not run contiguous to the rectum, I have sometimes found it difficult to perform the operation with a bistoury of any form. The difficulty, however, does not consist in passing the instrument from the sinus into the rectum, which, with

the common crooked bistoury, is in every case easily done, if the probe pointed part of it is properly made, but in turning the point of it down, so as to divide the parts from the opening at which it entered, to the under part of the gut : by cutting slowly and deliberately, I have always been able to do it ; but in one case, a bistoury of considerable strength broke while I was making the cut ; and in different instances I have known this happen with others : this has made me wish to have an instrument for this operation still more perfect than the bistoury : many have been proposed, but none that has yet appeared answer so well as the bistoury : I am at present using scissars of a particular construction ; but I cannot as yet speak of them with such certainty from experience, as to render it proper to lay them before the public, which, however, I shall do at some future period, if the trials that I mean to give them shall justify the opinion I have formed of them : I may here, however, shortly observe, that they consist of two cutting blades, which, after being introduced separately, the one into the sinus, and the other on the finger previously passed into the rectum, are joined at their axis by a moveable pin, in which state being able to act like common scissars, the operation is finished by a single cut.

CHAPTER XXXIX.

OF FRACTURES.

SECTION I.

General Observations on Fractures.

SOME practitioners denominate every solution of continuity in a bone, a fracture ; but the term may, with more propriety, be confined to divisions in bones produced by external violence. Thus, we do not say that a bone is fractured, the parts of which are separated from each other by the effect of internal disease ; while we say that it is fractured when this happens from a fall, a blow, or a bruise.

Fractures are of various kinds, and are distinguished by different names. A bone may be fractured either directly across ; in an oblique direction ; or longitudinally : hence the terms, transverse, oblique, and longitudinal fractures. When a bone is split, we say that it is splintered.

When the teguments remain sound, a fracture of a bone is denominated simple ; and we term it compound when the fracture communicates with a wound in the skin and other corresponding soft parts. By some a fracture is said to be compound when a bone is broken into different parts ; and those fractures they term complicated, that are accompanied with wounds in the corresponding soft parts. This subdivision, however, of fractures, seems to be unnecessary : for unless a bone is splintered, no essential difference arises merely from its being broken at one or two parts ; whereas the slightest communication between a fracture and a wound in the surrounding soft parts, chang-

es the nature of it so entirely, as often to induce much danger where no alarming symptoms would otherwise have been dreaded.

The existence of fracture is, for the most part, easily discovered, by manual examination. A fracture of a single bone, where there is only one in the fractured limb, and the fracture of both bones when there are two, as well as fractures accompanied with extensive wounds of the contiguous soft parts, are easily discovered : but in simple fractures, where only one bone of a limb has suffered, it is often difficult to judge with any degree of precision ; particularly where the contiguous parts have become tense and painful. In such cases, our opinion must be formed by a minute attention to different circumstances ; the age and habit of body of the patient ; the site of the supposed fracture ; the situation of the limb when the injury was received ; and, lastly, the attending symptoms.

In old age, bones are more easily fractured than in earlier periods of life. In infancy, bones will rather yield than break on the application of a moderate force ; whilst in old age they become so brittle, that even the largest are frequently broken by very trifling falls and bruises.

Different diseases induce this brittle state of the bones ; particularly lues venerea. Of this I have met with various instances. In some of these, the largest and hardest bones were broken, solely by the ordinary action of the muscles of the limb. This I have also known happen in sea scurvy : bones that have been fractured and long united, are apt to separate in advanced stages of scurvy, the callus being either dissolved or rendered too soft for the purpose of retaining them together.

Besides these general diseases of the body, the bones themselves are liable to a disease that renders them soft and flexible. This is usually termed *mollities ossium*. In some, this goes no farther than to produce that state of the bones that I have mentioned, in which they are

apt to be fractured by slight falls and similar accidents : but in others, it has been known to proceed to such a height, that every bone in the body has become crooked and distorted. I have seen a skeleton in which the condyles of the knee joints were turned up so as to touch the pubes, and in which every other bone was crooked in nearly a similar degree.

In judging therefore of the probability of a fracture from the degree of violence that has been applied, these circumstances merit attention : for it is evident, that in old age, and in these diseased states of bones, a degree of force will produce fracture, which in other circumstances it could not possibly do.

The site of a supposed fracture is also to be taken into consideration. Bones are more apt to be broken in those places where they are hard and brittle, as in the firmer parts of all the long bones, than towards their extremities, where they are of a more soft and yielding texture ; and bones that lie deep under the cover and protection of muscular parts, as in the thighs, are not so frequently fractured as those of the arms and legs that are not so well protected.

Further, the situation of a limb when an injury is inflicted, is an object of inquiry. Thus, a very inconsiderable weight passing over a bone lying on an unequal surface, will readily produce a fracture ; while the same bone, equally supported, will bear a heavy load without being much injured.

In forming an opinion of the probability of a bone being broken, we ought, lastly, to take into consideration the symptoms that usually accompany fractures. These are, pain, swelling, and tension in the contiguous parts ; a more or less crooked and distorted state of the limb ; a crackling or grating noise on the parts being handled ; and loss of power to a certain degree in the injured limb.

It is true, that the mere fracture of a bone is not necessarily attended with much pain ; for the bones, not being so plentifully supplied with nerves as the

softer parts of the body, they are therefore of a less irritable nature. But pain arises from two circumstances with which fractures are usually attended; the contiguous soft parts being bruised and otherwise hurt, in the first place by the force producing the injury, and afterwards by the displaced ends of the bones. For the most part the pain indeed is not very severe: but in some it is so violent as to induce the most alarming symptoms; spasmodic twitchings of the muscles of the limb; high degrees of inflammation; fever; general convulsions and delirium; and if the cause by which these symptoms are induced be not soon obviated, they sometimes even terminate in death. In general this is preceded by mortification of the parts contiguous to the fracture; but in some these symptoms prove fatal, without any tendency to gangrene being perceived.

When the force by which a fracture is produced has been extensively applied over a limb, we may readily suppose that the severest symptoms may be induced by this cause alone; but in general we find, when the pain, tension, and convulsive twitchings of the muscles are severe, that they chiefly arise from the adjoining membranes, muscles, and other soft parts being torn, punctured, or compressed, by the ends of the fractured bones: and although this may happen in fractures of every description, yet it will necessarily be more frequent in those that are so oblique as to admit of the bones passing easily over each other, than in transverse fractures, where the parts, on being replaced, more readily remain in their natural situation.

The other diagnostic symptoms of fracture that I enumerated, namely, a grating noise on the parts being handled, and distortion and loss of power to a certain degree in the injured limb, must necessarily take place in every fracture. They are indeed much more evident in some fractures than in others; but in all, they may be discovered where the parts are not much swelled, excepting in the case of a longitudinal or splin-

tered fracture. A bone may be split in this direction without any of these symptoms taking place : for unless the divided parts be completely separated from each other, neither distortion nor crackling will be perceived on handling them ; nor will the bone be rendered altogether incapable of performing its usual functions. In such cases, we judge of the probability of a fracture, from the violence of the injury, the severity of the symptoms, and other circumstances already enumerated.

Besides these leading symptoms of fractures that take place immediately on the injury being inflicted, there are others which occasionally occur from the first, and some that we are to consider as consequences rather than symptoms. Of the first, the most remarkable are, that great degree of ecchymosis which in some cases appears instantaneously, from the ends of a fractured bone having penetrated a contiguous artery or vein ; and the wound or laceration of the teguments in compound fractures.

The most important consequences of fractures are, stiffness and immobility of the injured limb ; distortion of the parts chiefly affected, either from a fulness or thickness remaining in the contiguous muscles or ligaments ; an exuberancy of callus ; a contracted state of the contiguous joints ; or a marasmus or wasting of the limb itself. All these we shall consider more particularly in speaking of the treatment of fractures.

In judging of a fracture, and of the probable event of it, various circumstances are to be considered : particularly the age and habit of body of the patient ; the situation of the bone, and the part of it that is injured ; the nature of the attending symptoms ; the circumstances with which the fracture may be complicated ; and the kind of fracture.

With respect to the first of these, namely, the age and habit of body of the patient, we all know that they are points of much importance in the cure of every injury ; and in none more than in fractures. Thus

in youth, particularly in infancy, fractures are more quickly cured than in old age; and in sound constitutions, more readily than in those that are diseased. I have observed above, that the bones sometimes become brittle in lues venerea; and it may here be remarked, that the existence of lues venerea and scurvy, is particularly adverse to the reunion of fractured parts. I have met with some exceptions to this, where fractures have united readily even in advanced stages of lues venerea: but this is uncommon; and where lues venerea has attacked the bones, a firm callus seldom forms till the virus is eradicated.

In speaking of the effect of age on the cure of fractures, although I admit that the divided parts of bones unite more speedily in infancy than in old age, yet I think it right to remark, that they do not reunite with more certainty. By many we are told, that in advanced periods of life, the union of fractured bones is often not to be accomplished. I have never, however, seen an instance of this, although I have had the management of many fractures even in extreme old age.

The situation and part of the injured bone, are both circumstances that merit attention. Thus we know, that fractures of the small bones of the arms and legs, of the feet and hands, and of the ribs, in general heal easily; while fractures of the larger bones, particularly of the femur and humerus, are managed with more difficulty. In the last, indeed, one principal cause of the cure proving tedious, is the difficulty of retaining the ends of the bone together.

When any of the large bones are fractured near to their extremities, we find the danger is greater, and the prospect of a complete cure much less, than when they are broken near to their middle: for here the shortness of one end of the bone makes the retention difficult; and the symptoms that ensue from fractures in this situation are apt to be particularly severe, not only from the contiguity of the capsular ligaments of

the joints, which may thus be injured, but from the numerous tendons that are inserted into these parts of the bones; which may not only be lacerated and bruised, but even torn from their insertions. Besides, the ends of bones are not only soft, but even spongy or cellular in their texture, by which fractures in these parts do not unite so equally; the parts more frequently exfoliate, and matter is more apt to form in them: hence when fractured they are more tedious in the cure, and give rise to more troublesome symptoms, than similar accidents in the harder parts of bones.

It is also proper to remark, that fractures near the extremities of bones are frequently productive of stiff immoveable joints, unwieldy limbs, pains and swellings; which, in various instances, even under the best treatment, continue obstinate for a great length of time, and in some cases even during the life of the patient.

We are in general led to suppose, that these consequences arise solely from mismanagement, either on the part of the surgeon or of the patient. That in some instances this is the case, no person will doubt. The ends of a fractured bone may be improperly placed from the first by the practitioner, or they may be afterwards misplaced by the patient; and in either case we may conceive that all the symptoms I have mentioned will take place. But in justice to the profession, I must observe, that they more frequently arise from the situation and nature of the fracture than from any other cause. Nor is it surprising that it should be so. When we consider the various circumstances with which fractures are often accompanied; the degree of violence required to break a large bone; the severe contusion of the contiguous soft parts which this must produce; and the laceration of nerves, muscles, and ligaments, that must occur from the spiculæ of fractured bones; we should rather expect that they

would more frequently induce distressful consequences than we actually find to be the case.

In forming a judgment of the nature and probable event of fractures, the symptoms merit particular attention. If the symptoms are moderate, when compared with the violence that the parts have suffered, our prognosis should be proportionally favourable: but when the attending symptoms are severe, particularly if the pain is uncommonly violent, and the swelling and tension considerable, however trifling the force may have been by which the fracture was produced, the case will probably be difficult to manage, and uncertain in the event. In such circumstances, therefore, even in simple fractures, our prognosis should be guarded.

The circumstances with which a fracture may be complicated, are likewise of importance; and unless they are duly weighed, no accurate judgment can be formed of the event. The contiguous muscles and other soft parts may be severely contused; some of the ligaments and tendons of the injured part may be ruptured, or even torn from their insertions; and the fracture may be combined with a dislocation of one or both of the contiguous joints. These accidents in every instance aggravate the danger.

The last consideration on this subject respects the kind of fracture. The greatest difference is observed between the event of a simple and of a compound fracture. A great proportion of cases of simple fracture are of a mild nature from the first; and with very ordinary attention, complete cures are obtained: but in compound fractures, the smallest external wound communicating with the injury in the bone, will often produce the greatest danger. I do not mean to say that this always happens; on the contrary, we know that even the worst cases of compound fractures will, with proper attention, often terminate in a favourable manner: but every practitioner versant in this branch of business, will allow, that this is seldom

the case; and that even under the best management such cases are so apt to go wrong, as to warrant the opinion that I have given of them, and to render it proper in almost every instance to give a guarded prognosis.

Various indications have been proposed for the cure of fractures; and those we are desired to have particularly in view, are, extension; counter extension; coaptation, or replacement of the fractured parts; deligation, in so far as is necessary for retaining them; position of the injured part; and prevention or removal of bad symptoms.

The subject, however, may be simplified, and the indications with propriety restricted to three: to replace the parts of the bone that have been moved from their natural situation; to retain them in this situation as long as may be necessary; and to obviate such symptoms as may supervene during the cure.

In some few favourable cases, where the bones are fractured directly across, they are either not moved out of their natural situation, or the alteration is so inconsiderable that they are easily replaced. But when the bones of a limb are broken in an oblique direction, they are apt to pass one another so as to produce much deformity and pain. The contiguous muscles are thus severely injured, and excited to violent action: hence the malady is increased by every exertion; and nothing will remove it but an artificial replacement of the distorted bones.

To accomplish this, various methods have been proposed. In former times it was done by much violence and force; by what was termed extension and counter extension: but we now know that our purpose may be accomplished in an easier manner, with less pain to the patient, and less trouble to the operator.

As long as it was imagined that much force was necessary, the limb was extended by one or more assistants pulling at each end of it; and when this was not sufficient, different machines were employed for

it. This force was in general applied while the limb was stretched out or extended, by which it became much more difficult to reduce the displaced ends of the bone: for in this manner all the contiguous muscles were put into action; nor could the bones be replaced till this was overcome by the application of a superior force. The mischief that this would often produce, it is easier to imagine than express.

When it is considered, that in the reduction of fractured bones, the chief resistance arises from the action of the corresponding muscles, the propriety of placing the limb in such a posture during the operation, as may favour the relaxation of these muscles, is so evident, that we now reflect with surprise, that it should have been left to the practitioners of the present age to propose it. For, whatever may have been the opinion of a few, it is certain, that till lately it was the general practice to keep every limb in an extended position while any attempt was making to replace the fractured bones, and that it is chiefly to the late Mr. Pott we owe the present improved state of this important branch of surgical practice.

If in the treatment of fractures, we take care to relax all the muscles of the limb, it is surprising with what ease the ends of the bones may in general be replaced. When a limb is laid completely in this relaxed posture, the surgeon will in most cases be able to replace the bones without any assistance: but when this does not succeed, a slight degree of extension may be employed, by the upper part of the limb being kept firm by one assistant with his hands placed between the fracture and the contiguous joint, while the under part of it is gently extended by another; care being still taken, however, to keep the muscles as much relaxed as possible.

As it is of much importance, in replacing the fractured parts of a bone, to do it with accuracy, the most minute attention should be given to this part of the operation. Every inequality depending upon any por-

tion of a displaced bone, should, as much as possible, be removed, so as to render the injured part similar to the corresponding sound limb ; which, for the purpose of a more attentive examination, should be placed as near to it as the conveniency of the operator will permit.

The necessity of attention to this part of the treatment will particularly appear from this, that when the fractured bones are not properly reduced at first, the limb must either remain always distorted, or be put right during a future stage of the cure, when it will necessarily be done with more pain to the patient, and more trouble and perplexity to the surgeon.

The bones being put right, our next object is to retain them as long as may be necessary in this situation. This we do with splints and bandages, and placing the limb in such a state of relaxation as will admit of its resting with ease, and without being disturbed, till the cure is completed. In treating of fractures of particular bones, the posture in which they should be placed, and the bandages best adapted for their retention, will be described. I may merely observe at present, that no bandage should be more tightly applied than merely to retain the bones in their situation ; and that this may, for the most part, be easily done, if the limb is kept in a relaxed posture.

The time required for the firm reunion of fractured bones depends upon various circumstances : upon the size of the bone, and the weight that it has to support ; on the age and habit of body of the patient ; and on the cure having proceeded with more or less interruption, from the limb having been kept more or less steadily in its situation, as well as from the attending symptoms of swelling, pain, and inflammation, having been mild or severe. In a healthy middle aged patient, where no untoward symptoms have occurred, and when the injured parts have been retained exactly in their situation, a cure of a fractured femur, or of the bones of the leg, will be accom-

plished in two months ; of the humerus and bones of the fore-arm, in six weeks ; of the clavicles, ribs and bones of the fingers and toes, hands and feet, in three weeks. In infancy and childhood, fractures in all these parts heal more quickly, while in old age this uniting process goes on more slowly, and therefore requires more time to accomplish.

In simple fractures, to which these general observations more particularly apply, the pain, tension, and other symptoms, are in general moderate, and usually subside entirely in the course of a few days, if the bones are properly retained in their situation ; but in some cases, instead of diminishing, they become daily more violent, so as to be productive of much distress to the patient, as well as trouble and embarrassment to the practitioner.

When the muscles and other soft parts of the limb have not been much contused, no remedy should be advised merely with a view to the prevention either of tension or pain : but when much violence has been done to the limb, these symptoms should be guarded against by the early use of astringent applications, such as solutions of saccharum saturni, of crude sal ammoniac, and spiritus Mindereri ; and when these fail, by a free application of leeches over the injured parts. Indeed, the practice of taking away blood by leeches proves in every instance so highly useful, that I always advise it when the tension is considerable, or whenever the pain continues severe after the bones have been replaced. In every fracture, inflammation is the symptom which, in the first place, we have most reason to dread ; and as nothing tends with such certainty to prevent or remove it as local bloodletting, it should never be omitted at first when the surrounding soft parts are much injured : nor should it afterwards be delayed when it appears to be necessary ; for this remedy proves always most effectual when employed early.

Besides the immediate advantage of relieving the pain in the injured part, nothing prevents with such

certainly the troublesome consequences of contusion in cases of fracture, as the early application of leeches. Of these consequences, the most remarkable are, deep seated abscesses, which in some instances form within the cavity of the bone itself, and in others in the surrounding cellular substance; long continued pains, resembling rheumatism, stretching over the injured limb; a thickened enlarged state of the periosteum and other soft parts; a stiff contracted state of the contiguous tendons; an exuberancy of callus; and an unwieldy state of the whole member.

It is well known to every surgeon of experience, that all of these consequences are apt to succeed to fractures accompanied with much contusion; and nothing proves more perplexing to surgeons, or more distressful to patients; for when they are not soon removed, they are very apt to prove permanent; and for the most part this is laid to the charge of mismanagement in the reduction of the fracture.

In many instances these consequences no doubt proceed from the extremities of the fractured bone not being properly replaced, or not retained with exactness afterwards: but they more frequently proceed from the inflammation that succeeds to contusion. It is therefore evident, that early local bloodletting is in such circumstances most likely to prove useful. When swelling and pain in a fractured limb have continued long, the most effectual relief is obtained from frictions with emollient oils, and from tepid bathing in warm sea water, and in the waters of Buxton, Bath, and Barreges. But in the early stages of fractures, nothing removes the pain with such certainty as a plentiful discharge of blood from the injured parts.

We are sometimes disappointed in the cure of fractures, by the limbs remaining unseemly from an overgrowth of callus. This is not indeed a frequent occurrence, but every practitioner must have met with it: being most apt to take place where the symptoms of inflammation have been severe, I have regularly or-

dered local bloodletting, for the prevention and removal of this exuberancy of callus, and commonly with much advantage ; but, in some cases, the tendency to form callus is so great, that it can scarcely be checked. The application of ardent spirits, and other astringents, is here supposed to prove useful : and I have in some instances derived advantage from continued gentle pressure, applied by means of a thin plate of lead adapted to the form of the part, and retained with a proper bandage : but as neither this nor any other remedy will prove successful in every case, and as patients are apt to regret nothing so much as disappointment in obtaining a complete cure of a fracture, our safest course, as soon as the callus begins to be luxuriant, is to acquaint the patient with the probable event ; and he must be very unreasonable indeed, if he afterwards repines at what the utmost care and attention could not prevent.

Among the consequences that sometimes result from fractures, there is one that merits more particular consideration, namely, the difficulty of obtaining an union between the ends of the fractured bones, by which they remain loose and detached long after they should have been firmly united.

This may proceed from various causes : from constitutional diseases, such as rickets, scurvy, or lues venerea ; from the ends of the fractured bones not being kept steadily in contact till completely united ; from a portion of a muscle, tendon, or ligament, falling between the ends of the fractured parts, so as to prevent them from being placed in contact ; and in some, from a bone being broken in different parts, and the intermediate detached pieces being so small as to prevent them from adhering, even when kept in close contact.

It has been observed, too, that a state of pregnancy proves inimical to the recovery of fractured bones. This has not indeed fallen within my observation ; but it appears to be the general opinion of practitioners, and different instances of it are upon record.

When this want of union proceeds from any general disease of the system, this disease must be removed by the remedies that experience has shewn to prove most effectual ; for no attention on the part of the surgeon will be of any avail till this is accomplished ; and as much mischief is often prevented by an early application of remedies, they should always be advised as soon as the cause is found to exist. It would even be a prudent precaution, where a patient at the time of receiving a fracture is known to labour under any constitutional disease, to advise an immediate application of remedies ; by which means cures might be often quickly accomplished, which otherwise are protracted to a great length.

When a cure is interrupted by the fractured ends of bones not being kept in their situation, they should be replaced and retained with as much accuracy as possible ; and when the injury is still recent, often, indeed, for the space of two or three weeks, a perfect union may thus be accomplished.

But where fractured bones have remained for any considerable length of time disunited, the osseous matter by which they should have been knit together becomes hard, smooth, and totally unfit for the purpose, insomuch that no advantage could be derived from their being replaced. Of this I have met with various instances, where the ends of the fractured bones were become perfectly smooth, and moved on each other with nearly the same ease and freedom as the bones of any of the joints.

In this situation, when the inconvenience which it excites is inconsiderable, the patient should be advised to submit to it, particularly in fractures of the small bones, such as those of the fingers and toes, the bones of the metacarpus and metatarsus, the clavicles, and ribs, rather than to any operation for effecting a cure ; but in the large bones of the extremities, where much firmness is required, and where this kind of injury destroys the use of the limb, as we may be able by an

operation to restore it, we ought perhaps in every instance to propose it. By making an incision through the surrounding soft parts, so as to lay the ends of the bones bare, and removing a small portion of each of them, either with a common saw, or with the head of a trepan, we reduce them to the state of a recent fracture; when, by taking care to retain them in a proper situation, we may in due time accomplish a cure.

The operation is no doubt painful and tedious; for the incision must be extensive, in order to admit of a free application of the instruments; and it requires to be conducted with caution, that the large blood vessels of the limb may be avoided: but it may be done with perfect safety by any person accustomed to the operative part of surgery.*

Nor should we be deterred from proposing this method of cure, from any apprehension about the vacancy that may be produced by the removal of the ends of the bones: for if the limb is kept steadily in its situation, and if the constitution is healthy, nature will not probably fail in supplying the deficiency. Thus, many instances are upon record, even of entire bones being regenerated; and, in a lesser degree, the powers of nature on this point must have fallen within the observation of every practitioner.

A bone is often broken in different parts, and a cure notwithstanding obtained: but when the detached parts are so small that the circulation will not probably be kept up in them, as they will thus be rendered incapable of furnishing the secretion by which their reunion should be accomplished, it would be better to remove them at once, than to impede the cure by any attempt to save them. Accordingly, in all compound fractures, where the injured bone is already laid bare, it is the best practice to remove all such detached portions as might not probably unite with the remaining parts of the bone. But in simple fractures,

* Vide White's Cases in Surgery, where two instances of this are recorded.

where the skin remains entire, as we cannot judge with such certainty of the nature and extent of the injury, nor of the probability of our being able to preserve the loose portions of bone, we should endeavour, in the first place, to accomplish a cure in the easiest manner, by placing the parts in such a position as will most readily admit of their reunion : but when this does not succeed, when the ends of the bone remain loose long after they should have been united, and if one or more detached pieces are discovered, these are to be considered as extraneous bodies, and ought accordingly to be removed, either with the fingers or forceps, at an opening made through the soft parts for this purpose.

Experience enables me to recommend this practice with confidence. I have met with various cases in which cures were judged to be impracticable, from no union being formed between the ends of bones that had been long fractured, and in which I proved successful at last, by the removal of some loose fragments.

But the most perplexing cause of failure, in the treatment of fractured bones, is a portion of a muscle, ligament, or some other soft part passing between them. We judge that this is the case, when the pain and tension of the injured part have been more severe than usual from the first ; when particular movements of the limb occasion severe pain and twitchings of the muscles that serve to move it ; and when the ends of the fractured bone do not unite at the usual time.

As soon as there is reason to think that the cure is prevented by this cause, we should endeavour to remove the portion of interposing membrane or muscle, by putting the limb into every variety of posture. But when this does not succeed, as may sometimes be the case, and when the bones still remain loose long after the usual period, we ought, without further hesitation, to make an incision upon the fractured part. When the injury has not been of long duration, a cure will be accomplished merely by bringing the ends of the

fractured bone into contact ; but when this measure has been long delayed, and when the osseous matter poured out by the fractured extremities of the bone has become hard, a small part of it should be removed either with a saw or some sharp instrument, so as to convert the injury once more into the state of a recent fracture ; otherwise no advantage will be gained by the operation.

Besides these causes that I have mentioned, which tend to impede the cure of fractures, it may not be improper to remark, that the effusion of much blood round the injured bone, is very apt to do harm. In cases of simple fracture, the larger blood vessels are seldom injured ; and blood effused from small arteries is for the most part soon absorbed, and no bad consequences ensue from it. But instances sometimes occur, even in simple fractures, of large blood vessels being cut by the sharp spiculæ of the bone. When the quantity of blood thrown out is considerable, the tumefaction of the limb becomes so great, that it is necessary to lay it open in order to secure the injured vessel with a ligature : but where the swelling does not arrive at any alarming height, we rather trust to the natural contractility of the artery, for stopping the hemorrhagy, and to the powers of the absorbents, for removing the blood already effused. In some such cases, where blood has remained long in contact with a fractured bone, the power of forming callus appears to have been destroyed by it ; the periosteum separates for a considerable space from each end of the bone ; and on laying the parts open, no union is found to have taken place ; the spiculæ produced by the fracture remain equally sharp as at first ; and, for the most part, a thin fetid sanies is discharged from the sore.

In this situation, a cure will not be obtained till those parts of the bone which have been denuded of the periosteum have exfoliated ; and, as exfoliation is in general a tedious process, I would rather advise the removal of the denuded bone with a saw ; by which

a more expeditious and more certain cure would be obtained.

Having premised these general observations, we proceed to the consideration of fractures of particular bones.

SECTION II.

Of Fractures of the Nose.

THE arch formed by the bones of the nose, prevents them from being so frequently fractured as they otherwise would be. They are necessarily, however, liable to every variety of fracture when exposed to much violence.

Besides the usual symptoms of fractures, injuries of this kind in the bones of the nose are apt to impede respiration; they hurt the speech and sense of smelling; polypi and tedious ulcers sometimes ensue from them; and they are more hazardous than fractures of other bones, from their contiguity to the brain. These fractures, therefore, require very accurate attention.

When we have ascertained the nature and extent of the fracture, our next object is to replace, with as much accuracy as possible, such parts of the bones as are displaced. When any part of them has been raised above the level of the rest, it must be pressed into its situation with the fingers; while such parts of them as may have been forced into either of the nostrils, must be elevated with the end of a narrow spatula, or any other instrument of a similar form. Any portion of bone that is quite loose, and nearly separated from the rest, should be removed immediately, whether it be raised up or forced into the nostril; but whatever adheres firmly to the remaining portion of bone should be replaced.

If the bones are properly replaced, they will for the most part remain in their situation without assistance.

If the soft parts have been injured, they must be dressed in the usual way; and whether they are hurt or not, we should endeavour to prevent inflammation by the use of saturnine applications, and by local blood-letting when the violence of symptoms seems to require it.

But when the parts that have been replaced do not remain firm in their situation, something must be done to retain them. If they fall into the nostrils, we succeed best by the introduction of tubes of such a size into them, as may preserve the fractured bones in their situation. The form and size of these tubes are delineated in Plate XXVI. fig. 2. If the tubes are covered with soft lint, spread with any emollient ointment, they may be kept in the nostrils as long as is necessary: while, on the contrary, if any part of the bone is raised above the rest, it must be kept down by a proper application of a double headed roller. If the teguments are injured, the fore must be first dressed; care being taken in doing it to prevent deformity as much as possible: a compress of soft old linen must be next applied; and over the whole an equal pressure with the bandage I have just mentioned.

In this manner a cure may be obtained of almost every injury of this part, unless the bones have been so much shattered, that their reunion cannot be accomplished: in which event, all that art can do is to extract the detached pieces, and to co-operate as much as possible with nature in healing the remaining fore.

SECTION III.

Of Fractures of the Bones of the Face.

WHEN treating of fractures of the skull, in Chapter X. those of the upper part of the face were considered. At present, therefore, I have only a few observations to offer on fractures of the su-

perior maxillary and cheek bones, being those which form the most prominent parts of the sides of the face.

The vicinity of those bones to the eyes and nose, and the situation of the antrum maxillare, make fractures in this part highly important. When fractures stretch toward the eyes, they are apt to induce severe degrees of inflammation; and when they penetrate the antrum, they not only prove tedious, but commonly occasion much deformity: for when the anterior part of that cavity is laid open, and any portion of the bone removed, the face becomes flat, and the teguments puckered, notwithstanding all that can be done to prevent it.

In all such injuries, therefore, we should with the greatest care replace any portion of bone that may be fractured, so as to favour its reunion with the rest; and any wound that accompanies the fracture, should be dressed with much attention, that deformity, as far as possible, may be prevented.

After the bones are replaced, which may be done with the fingers where there is no wound, and with forceps or a narrow spatula when the parts are laid open, a piece of adhesive plaster will answer better than any bandage for retaining the dressings. Blood-letting, and an antiphlogistic regimen, must be advised to obviate inflammation of the eye or contiguous parts, which otherwise might ensue. The remaining part of the cure, namely, the reunion of the fractured parts of the bone, must be left to nature.

When a fracture penetrates the antrum maxillare, the matter which collects in that cavity cannot be properly evacuated from any opening that may take place on the prominent part of the cheek. In consequence of this, I have known sinuous ulcers formed that have continued open for a great number of years. They can only be healed by giving a free vent to the matter, by an opening made in the most depending part of the cavity, in the manner I have advised in Chap. XIV. Sect. V.

SECTION IV.

Of Fractures of the inferior Maxillary Bones.

ALTHOUGH the bones of the under jaws are very strong and compact, yet fractures of one, or even of both, are not unfrequent. This seems to arise from blows and other injuries to which these bones are exposed, being most apt to fall upon their anterior flat surfaces, where they are less capable of resisting violence than in any other part.

We judge of the existence of a fracture in the jaw, by the deformity that it occasions; by the crackling of the bone when handled; by inability to move the jaw; by the violence of the injury, and degree of pain with which it is accompanied. When both jaws are broken, the injury becomes obvious; as in this case a considerable separation takes place at the fractured part: but even where one bone only is fractured, it may always with due attention be discovered.

The site of the fracture being ascertained, our next object is to replace the bones with as much care as possible: this we do by placing the patient in a proper light, having his head firmly secured, and the fingers of one hand pressing upon the inside of the jaw, while the other hand is employed externally in removing any perceptible inequality of the bone. One of the teeth is commonly seated in the course of the fracture; and in this situation acting as an extraneous body, and thus tending to retard the cure, it should be a general rule to take it out immediately: but when any of the teeth not seated in the course of the fracture, are forced out of their sockets, it may be right almost in every instance to replace them, and to endeavour to fix them, by tying them to the contiguous firm teeth,

This being done, our next object is to retain the fractured bones in their situation till they are firmly reunited. For this purpose, a variety of splints have been invented, both of pasteboard and other materials ; but as a compress and bandage, either of soft old linen or cotton, answers the purpose with equal certainty, and as it fits with much more ease to the patient, it should always be preferred. The parts being kept firm by an assistant, a thick compress should be laid over the chin, and be made to extend from ear to ear along each jaw ; and over the whole a four headed roller should be applied in the manner I shall mention when treating of bandages. In using this bandage, it should not be made so tight as to give much uneasiness, or to endanger the circulation, at the same time that it should be applied in such a manner as to keep the fractured parts of the bone in close contact.

During the cure, the patient should be kept perfectly quiet. He should be fed entirely on spoon meat. He should be enjoined neither to speak or laugh, nor to use his jaws in any manner of way. To prevent the bones from being displaced, which is apt to happen from frequent inspection, the bandage should be applied with such attention, that there may be no occasion to move it often. In compound fracture of this part, there is indeed a necessity for moving the bandage daily, as the sore cannot otherwise be dressed. It should always be done, however, with the utmost attention, an assistant taking care to support the parts with his hands during the whole time.

The management of a fracture of one or both jaw bones is exactly similar ; only where both bones are broken, still more attention is required than when one only is fractured. In a fracture of one of the bones, the patient may be allowed to eat soft meats, and to speak with freedom, in the space of three weeks : but where both bones have suffered, this should not be permitted till five or six weeks have elapsed.

SECTION V.

Of Fractures of the Clavicles and Ribs.

THE clavicles and ribs are more liable to fractures than any other bones. This proceeds, not only from the slender structure of these bones, but from the position in which they are placed, with their flat sides exposed to every injury that may be applied to them.

A fracture of the clavicle is in general easily distinguished. On the corresponding arm being smartly moved, a grating noise is produced by the ends of the bone rubbing against each other; the ends of the fractured part readily yield to pressure; and, in general, the end of the bone connected with the humerus, is pulled to some distance from the other by the weight of the arm. The motion of the humerus is impeded, and some degree of swelling, accompanied with more or less pain, takes place over the injured part.

In almost every instance of a fractured clavicle, the end connected with the sternum is higher than the other, which has suggested an idea that has very universally prevailed in the method of cure. The height of this part of the bone is supposed to proceed from its having started or risen out of its natural situation: in the reduction, therefore, of the fracture, much pains is commonly taken to press it down, and very tight bandages are employed to prevent it from rising during the cure. It will, however, be found, that this part of the bone rises very little out of its natural situation, and that the appearance of its doing so proceeds almost entirely from the other end of the bone being dragged down by the cause I have mentioned, namely, by the weight of the arm. At any rate, no advantage is obtained from this practice: for a force

that would be necessary for pressing down the end of the bone, cannot be applied without the effect of cutting the teguments, by pressing them against that part of it that is supposed to be raised; while our purpose is fully answered by raising the arm, and supporting it at a proper height. The depressed portion of the fractured clavicle is thus raised and brought into contact with the upper part of it. In some cases, indeed, of oblique fractures, it may be impossible to bring the ends of the bone in every point exactly opposite to each other: but this may be always so far accomplished as to enable us to avoid deformity, and to render the bone sufficiently strong.

When the ends of the bone are brought into contact, our object is to retain them in this situation till they are united; and, as I have observed above, this can only be done by affording a proper support to the arm.

The arm is usually supported by a sling hung round the neck, adapted to the length of the arm, and every where equally applied to it. But the leather case represented in Plate XCVI. fig. 1. answers the purpose with more ease and neatness. It supports the forearm and elbow joint more equally and more securely: this last, I may remark, is a point of no small importance; for if the elbow is allowed to drop, the humerus and scapula will both fall down, by which the ends of the fractured clavicle will again be separated.

We are commonly directed, in the cure of fractures of this bone, to have the shoulders drawn back and the head raised; and instruments are described for effecting these purposes. No general rule, however, of this kind can be given: for in some cases the fractured parts of the bone are kept exactly together when the head is bent down upon the breast; while in others, it is better accomplished when the head and shoulders are raised.

In other points, fractures of the clavicle must be treated like similar injuries in other parts of the body.

When severe pain takes place, bleeding with leeches becomes proper; but in general, the symptoms arising from fractures of this bone are of so little importance, that the common saturnine applications prove sufficient. When the fracture is accompanied with a wound, any splinters of bone that may be discovered must be removed, and the wound itself dressed in the usual way. It is proper, however, to remark, from the vicinity of the subclavian artery, that the removal of any portion of the clavicle may be attended with danger, and ought therefore to be managed with caution.

When the ends of the fractured part are properly supported, they will in general be firmly united in the space of a fortnight; but the corresponding arm should never be used with freedom till the end of the fourth or fifth week.

We discover fractures of the ribs by the seat of the pain, and by pressure with the fingers. For the most part, the attending symptoms are moderate; the pain induced by the fracture is inconsiderable, no fever occurs, and the patient soon gets well: but in some instances the pain is severe from the first; the breathing becomes difficult, attended with cough and perhaps a spitting of blood; and the pulse is quick, full, and sometimes oppressed.

It will readily be understood, that a fractured rib cannot of itself induce any of these symptoms: but in some instances the ribs are not only fractured, but pushed inwards, by which the pleura and lungs are not only compressed but lacerated; from which we may easily perceive, how pain, oppressed breathing, and fever, should be induced; and from which also we may account for the emphysematous swellings described in Chapter XXI. Section V.

In all cases of fractured ribs, it is a safe and proper practice to discharge a quantity of blood proportioned to the strength of the patient. If any inequality is

discovered, by one end of the rib having risen above the other, we should endeavour by moderate equal pressure to replace it ; and to prevent it from rising, a broad leather belt should be applied and drawn as tight as the patient can easily bear it. When the belt is properly lined, either with quilted cotton or flannel, it sits with ease even when tolerably tight ; and it ought to be continued for several weeks after the accident.

Even where the symptoms have at first been severe, they commonly subside upon the patient being freely bled and kept quiet and on a low regimen : but where the oppressed breathing is kept up by air escaping from a puncture in the surface of the lungs, or by blood discharged from a ruptured artery into the cavity of the chest, or when the pain is prevented from subsiding by the fractured rib being forced in upon the pleura ; it becomes necessary to make an opening with a scalpel. Where a portion of rib is merely forced inwards, the opening should be made directly upon the injured part ; and on the rib being laid bare, the depressed part of it should be raised, either with the fingers, forceps, or a spatula. When the symptoms proceed from air or blood collected in the cavity of the chest, an opening should be made to discharge them, in the manner that I have mentioned in Chapter XXI. Section III. and V.

Fractures of the ribs should in every instance be treated with attention ; but particularly where a tendency takes place to phthisis pulmonalis, when the irritation produced by a fractured rib is very apt to do harm.

SECTION VI.

Of Fractures of the Sternum.

THE support which the sternum receives from the ribs, and the degree of elasticity of which it is possessed, render it less liable than it otherwise would be to be hurt by external violence. It must necessarily, however, be injured by great degrees of force. In some cases it is fractured without being displaced : in others, it is not only broken, but at the same time beat in upon the pleura.

A simple fracture of the sternum is to be considered in the same light with similar injuries done to the ribs, and to be treated in the same manner. But more danger is apt to ensue from any portion of this bone being forced into the chest, from the vicinity of the large blood vessels of the breast, while the symptoms with which it is accompanied are nearly the same ; namely, pain in the injured part, cough, oppressed breathing, a quick and sometimes an oppressed pulse.

By some we are told, that the depressed portion of bone may be raised by desiring the patient to make deep inspirations ; by placing a barrel or a drum under his back, and keeping him lying for some time in this posture ; and by the application of adhesive plasters over the corresponding teguments ; when, by elevating the soft parts, the bone beneath, it is said, may frequently be raised along with them.

It is not possible, however, to suppose, that much advantage is to be derived from any of these means : they may more likely, indeed, do harm ; nor would I have mentioned them here, had it not been with a view to caution the younger part of the profession, who, finding these modes of practice recommended

by all the older writers, might have been induced to adopt them without weighing their import. As the skin is no where very intimately connected with the bone beneath, it is not probable that any portion of depressed bone will ever be raised by the external application of adhesive plasters; while, by advising deep inspirations, or laying the patient upon his back over a convex body, we would often do harm, by forcibly pushing the lungs against the depressed portion of bone.

When it therefore happens, that the pain, cough, oppressed breathing, and other symptoms, do not yield to bloodletting and other parts of an antiphlogistic course, some other method of cure should be attempted. An incision should be made upon the injured part, of a length sufficient to admit of a free examination of the bone; when the depressed piece may be raised with a levator, if the opening will admit an instrument; or when the opening in the bone is not sufficiently large for this, a perforation may be made with the trepan, in the manner I have advised in Chapter X. in similar injuries done to the skull.

I know that many will judge this to be hazardous; but when a patient is in danger, either from a portion of depressed rib or of the sternum, and which cannot otherwise be raised, I would never hesitate in advising it. If the operation is performed with caution, the bone may be raised with safety; and this being done, the sore must be treated in the usual way. By this being neglected, either from timidity on the part of the operator, or from any other cause, many have died of phthisis pulmonalis, who otherwise might have been saved.

SECTION VII.

Of Fractures of the Vertebræ, Os Sacrum, Coccyx, and Ossa Innominata.

FRACTURES of the *vertebræ* may be produced by falls and blows ; but we meet with them more frequently from gunshot wounds, than from any other cause.

For the most part, they terminate fatally : for although many have survived such fractures a great length of time, yet they generally linger and die of the consequences. The spinous and oblique processes of the *vertebræ* may indeed be broken without immediate danger ; but very commonly the force by which this is effected, gives such a shock to the spinal marrow, as at last terminates in the death of the patient : and a fracture that extends through the body of a *vertebra*, will probably, in every instance, prove fatal.

We judge of the existence of this fracture, by external examination ; by the force with which it was effected ; by the severity of the pain ; and by the parts lying below the injured *vertebra* becoming paralytic when the spinal marrow has been injured.

When any of the external parts of the *vertebræ* are loose, we may in general replace them with our fingers ; and, confining the patient as much as possible to one posture, we may, by means of the napkin and scapulary bandage, retain them in their situation till they unite with the rest of the bone.

Where this cannot be done, a patient is in general left to his fate, as it is not supposed that we can with safety lay any of the *vertebræ* bare, for the purpose of replacing such parts of them as may be deranged : but wherever the spinal marrow appears to be compressed, and where there is reason to think that the compression is produced by the depression of a portion

of bone, as we know from experience that every such case will terminate fatally if the cause of compression be not removed, it would surely be better to endeavour to raise it, than leave the patient to certain misery and death. By laying the injured parts freely open, we may be enabled to raise that portion of bone by which the compression is produced; while, in such circumstances, it cannot add to the hazard of the patient, even allowing the attempt to prove abortive.

In a case where symptoms of paralysis were induced by a musket bullet lodged in the substance of one of the vertebræ, a complete recovery was obtained by extracting the bullet. A portion of depressed bone might often be removed with equal ease and safety; and there is reason to suppose that similar effects would often result from it.

In fractures of the os sacrum, the method of treatment must be nearly similar to what I have advised in fractures of the vertebræ; only, where the injury is seated near to the under part of the bone, as well as in fractures of the coccyx, when any part of it is pressed inward, we may in some cases be able to replace it, by pushing it out with the finger of one hand introduced into the anus, while we co-operate outwardly with the other.

Where any of the ossa innominata are broken, if the injury is deeply seated, the patient ought to be placed in that posture in which he finds himself in greatest ease, and confined as much as possible to this situation, till the bones have time to unite. Blood-letting, and an attentive regimen, suited to his strength and to the violence of the symptoms, may prevent the inflammation that usually supervenes from becoming severe.

In more external fractures of these bones, we are often enabled to replace such parts of them as have been forced out of their situation, and with the assistance of a proper bandage, we may also be able to retain them till a cure is completed. I have now seen

different instances of a considerable portion of the ileum being fractured and separated from the rest, and of a cure being accomplished, by replacing the detached parts, and retaining them with a broad roller passed several times round the pelvis and upper part of the thigh.

With respect to the application of this bandage, no particular directions can be given : it must depend entirely on the judgment of the practitioner ; who will apply it in the way that he thinks will make it answer the purpose of fixing the bones in the securest manner.

SECTION VIII.

Of Fractures of the Scapula.

THE scapula, from its situation, is not so liable to be fractured as other bones ; but every practitioner must have met with it. It may be fractured either in the thin plate, of which it is mostly composed ; or in one or other of its processes.

As the motion of the arm depends much on a sound and entire state of the scapula, and as fractures of any part of it are difficult to cure, they very commonly produce a stiff unwieldy state of the corresponding arm, which in some degree often continues during the life of the patient.

Fractures of this bone are discovered by the seat of the pain ; by the violence of the injury ; by manual examination ; and by stiffness and immobility in the corresponding arm. We are told, that fractures of the scapula are apt to be accompanied with emphysematous swellings ; but they can only appear when a splinter of the bone is forced into the lungs : when this takes place, air will no doubt escape ; and if it passes into the cellular substance, emphysematous swellings will necessarily occur.

In fractures of the scapula, our first object is to replace the fractured parts of the bone with as much exactness as possible : in doing so, we are much assisted by relaxing the muscles of the injured part. By raising the head and shoulders we relax the muscles of the back ; and if, at the same time, the humerus is supported, the deltoid muscle will be so much relaxed, that any fractured portion of the scapula will be more easily replaced. It is always however more difficult to retain the bones during the cure, than to replace them : for the detached portion being in general small, we can seldom retain it with a bandage. A proper application of a long roller is perhaps the best method of doing it ; and in using this bandage, we should still take care to have the head and shoulders supported, and the arm suspended, so as to keep all the muscles of the injured part as much as possible relaxed.

As all fractures are apt to excite inflammation, I have elsewhere observed, that this symptom should at all times be guarded against. No where is it more necessary to attend to this than in fractures of the scapula, where inflammation is particularly apt to proceed to an alarming height. Bloodletting should therefore be freely practised ; particularly local bloodletting with leeches, or cupping and scarifying ; a remedy that I consider as more effectual than any other for the removal of inflammation, wherever it is seated.

SECTION IX.

Of Fractures of the Humerus.

FRACTURES of this bone are easily discovered, as no part of it is thickly covered with soft parts ; oblique fractures become evident to the sight, but ev-

en those that are perfectly transverse become immediately obvious on the slightest manual examination.

In the reduction of fractures of this bone, we do not find that much extension is required; but that it may be done with ease, the muscles of the arm should be put as much as possible into a state of relaxation; this we do by moderately bending the elbow, while the limb is raised nearly to a horizontal direction; and not carried so much forward as to put the latissimus dorsi, inserted into the back part of it, on the stretch, or too far back to stretch the pectoral muscle.

The patient being properly placed, and the arm put in this situation, the surgeon will in general be able to replace the bones without any assistance; but when extension is necessary, it may be applied by one assistant grasping the arm between the fracture and joint of the shoulder, and another above the elbow.

In this manner the fractured parts of the bone are to be replaced; and with a view to secure the fractured parts in their situation, a firm splint, such as is represented in Plate LXXXI. figs. 5. and 6. should be placed on the outside of the arm, and another along the inside of it, each of them covered with soft flannel, to prevent them from galling the skin; and while these are secured by one assistant, and the fore-arm supported by another, a flannel roller should be applied over the whole, of such tightness as to support the ends of the fractured bone, without interrupting the circulation of the limb.

The fore-arm should be supported in a sling, such as is represented in Plate XCVI. fig. 1. and the patient may be either put to bed or allowed to sit, as is most agreeable to himself. It may not, however, be improper to remark, that it answers better to have the arm in a hanging position than laid horizontally on a pillow; particularly in oblique fractures of this bone, in which the weight of the limb has a considerable effect in preventing the ends of the bone from overlapping or passing each other. Even in bed, therefore,

where there is any danger of this, the patient should be placed in such a manner that his arm may hang, instead of being laid in the usual way upon a pillow. In transverse fractures, this precaution is not so necessary, as the ends of the bone, if once replaced, serve in some measure to support each other. But even in these, it is the best practice to support the fore-arm in such a manner that it may have some effect in pulling the under part of the humerus gently downwards.

When no urgent symptom takes place, such as much pain and swelling of the arm, the bandage should not be moved for several days : but about the seventh or eighth day, it is proper in every fracture to remove all the coverings, in order to see whether the bone is perfectly in its place or not ; for at this period, any accidental displacement may be easily put right, and a cautious inspection may be made with safety.

I have advised a roller to be employed for fractures of this bone ; and perhaps it is the only instance in fractures of the large bones of the extremities in which it should be preferred to the twelve tailed bandage. But whoever has used them both will find, that in simple fractures of the humerus, the roller is not only more easily applied than the other, but that it answers the purpose better.

Fractures of the humerus commonly heal more kindly than similar injuries of any other bone ; and when properly managed, they seldom leave either lameness or distortion of the arm. When no interruption occurs to the cure, either from severe pain, swelling, or inflammation, or from accident or mismanagement, the bone will in general be firmly united in less than a month ; but the limb should not be used with freedom till six or seven weeks have elapsed.

SECTION X.

Of Fractures of the Bones of the Fore-Arm.

THE bones composing the fore-arm are two in number, the radius and ulna. Being much exposed to injuries, they are very liable to fractures. When both bones are broken, the nature and seat of the injury at once become obvious; but when one bone only is fractured, especially the radius, as the firmness of the ulna keeps it on the stretch, and prevents it from being displaced, we do not so easily perceive the injury: the seat of the pain points out the injured part; and when either of the bones is fractured, a grating noise will be heard if the surgeon grasps the limb firmly above and below this part, and endeavours to move it in different directions.

In this examination, it is of much importance to distinguish the direction of the fracture with as much exactness as possible, particularly if near to the wrist; for upon this the chance of our making a perfect cure in a great measure depends; and in this situation, whether both bones or only one of them is broken, much attention is required to prevent the stiff uneasy state of the arm from continuing long after the bones are united: patients indeed often complain of this, in some cases during life; and I think it more frequently happens when the radius is broken by itself than when the ulna only is fractured, owing, I suppose, to the radius having a rotatory motion independent of the other, by which it is not so easily kept in its situation. And as there is nothing for which practitioners are more apt to be blamed than for those inconveniencies that succeed to fractures, we ought in every instance to be as much as possible on our guard against them.

On the seat of the injury being discovered, if any part of either of the bones is displaced, we ought, as soon as it can be done, to put it right. The patient being properly seated, and the muscles of the arm relaxed by gently bending the joints of the wrist and elbow, the fore-arm should be extended to such a degree, by one assistant grasping it above the fracture, and another below, as is just sufficient to allow the surgeon to replace the bones. This being done, one of the splints represented in Plate LXXXI. fig. 3. 4. or 5. covered with soft flannel, and of a length to reach from the elbow to the tops of the fingers, and of such a breadth as to incase rather more than one half of the arm and hand, should be placed along the ulna. Another splint not quite so broad must be placed along the course of the radius ; when both must be secured either with a flannel roller or a twelve tailed bandage, with such tightness as may prevent the bones from slipping out of their place, but without impeding the circulation, or exciting any degree of pain. In all simple fractures of these bones, the twelve tailed bandage, and simple roller, may be used with perhaps equal propriety.

In applying the splints, the palm of the hand should be turned towards the breast, this being not only the most convenient posture in which the arm can hang while in a sling, but the best in which it can at all times be placed, even when the patient is in bed : for in this situation the palm of the hand can neither be turned up nor down ; that is it can neither be put into a prone nor a supine posture, without giving that rotatory motion to the radius that I have mentioned, and which tends more than any other to displace any part of this bone that may be fractured. It should therefore be avoided ; and I know of no way in which it can with such certainty be done, as securing the arm with splints in the manner I have mentioned : it should now be hung in the sling represented in Plate XCVI. fig. 1. and allowed to remain in the leather

ease during the night, or in any small box of a similar construction, and of a size just sufficient to receive the arm when placed upon its side, but without permitting it to turn either one way or another.

In speaking of the splints, I have advised them to be of a sufficient length for stretching along the whole course of the arm from the elbow to the top of the fingers. The under splint ought more especially to be of this length; for the arm not only rests with more ease and equality upon a long splint, but it serves to cover the fingers, by which they are prevented more effectually than in any other manner from moving; a circumstance of much importance in every fracture of the fore-arm: for when a free motion of the fingers is permitted, it not only tends to keep up inflammation and pain, but is often the cause of the bones being again displaced, when otherwise they might have been kept in contact.

A partial dislocation of the bones forming the joint of the wrist, is not an unfrequent concomitant of fractures of the radius; from a combination of which, there is always much risk of stiffness being left in the joint, and of a painful permanent swelling over the under part of the arm: with this the patient should always be made acquainted; for even under the best management, a dislocation of the wrist, accompanied with a fracture of the contiguous bones, commonly ends in this manner: for the method of reducing the dislocation, I must refer to the ensuing Chapter; and I have already pointed out, in the first Section of this Chapter, what I conceive to be the best method of preventing and removing inflammation; which I have there shewn to be the most frequent cause of that stiff immoveable state in which fractured limbs are often left.

The olecranon, or upper end of the ulna, is sometimes fractured without any injury being done to the rest of the bone; this part of the bone being particu-

larly apt to suffer from falls and bruises upon the elbow.

In this case, in order to keep the fractured parts in contact, the fore-arm must be extended : and with a view to preserve the arm in this situation, a long splint should be laid along the forepart of it, from the upper part of the humerus to the tops of the fingers ; and this being secured with a roller, the arm should be allowed to hang by the side, to which it should be fixed with one or two straps.

It is proper, however, to remark, that it should not be long kept in this situation, otherwise a stiffness of the elbow-joint would ensue : with a view to the prevention of this, the bandage and splint should be removed about the eighth or tenth day ; when the fore-arm being for some time moved slowly backward and forward, and the joint rubbed with any emollient oil, the arm should be again secured as before. A cautious and daily repetition of this, while it prevents a stiff joint, does not retard the cure.

SECTION XI.

Of Fractures of the Bones of the Wrist, Hands, and Fingers.

THE bones of the wrist being small, round, and somewhat moveable, readily yield to any ordinary force that may be applied to them. On this account, they are seldom fractured, except by shot from firearms, or a heavy weight passing over them.

These bones are so small that when fractured, they are not easily retained *in situ*, and do not therefore unite so readily as bones of a larger size. For this reason, as well as from the contiguity of numerous ligaments and tendons, which gives rise to high degrees of inflammation, a complete ankylosis, or great stiff-

ness of the joint, often succeeds. After replacing the bones, these consequences are with most certainty guarded against, by a copious discharge of blood from the injured parts by means of leeches ; and this being done, the arm and hand should be well supported by a splint beneath, and another above, in the manner advised in the last section.

In fractures of the metacarpal bones, after being replaced with accuracy, a firm splint, either of timber or strong pasteboard, should be applied over the whole palm of the hand and inside of the arm, from the ends of the fingers to the joint of the elbow, in order to keep the hand in a state of extension, as the flexor muscles of the fingers cannot be bent without altering the position of these bones : and that this may with certainty be done, the long splints mentioned above, secured with a similar bandage, should be applied over the whole.

Fractions of the bones of the fingers are frequent ; but when properly treated, they readily unite, and the fingers become equally useful as before.

The best splint for a fractured finger is a piece of firm pasteboard fitted to it with accuracy, and softened in water till it is easily moulded to the form of the part. The finger being stretched out and the bone replaced, this splint should be applied along the whole length of it, and secured with a narrow roller. In order to prevent the injured parts from being disturbed, a large splint, either of the same kind of pasteboard, or of a thin piece of wood glued upon leather, as is represented in Plate LXXXI. figs. 3, 4, 5, or 6, should be applied over the inside of the hand ; and the fingers being stretched upon it, another roller should be put over the whole, to secure the fingers and hand, so as entirely to prevent motion.

With a view to preserve the motion of the finger joints, the bandage and splints should be removed about the tenth or twelfth day ; when all the joints

being frequently bent and extended, the whole should be tied up as before : and this being repeated daily, the splints may with safety be removed at the end of the third week ; when, by this piece of attention, the motion of the finger will be found complete, unless more than one bone has been broken, and at the same time severely splintered.

SECTION XII.

Of Fractures of the Femur or Thigh Bone.

WE meet with fractures in every part of the femur ; but more frequently in the middle than in any other part of it : next to this, that part of it which we term the neck of the femur, is most apt to be fractured.

Fractures of all the under part of this bone are for the most part easily distinguished, by the usual grating noise produced by the ends of it being forcibly rubbed together ; by the limb being much shortened if the fracture is oblique, or the ends of the bone displaced where the fracture is transverse ; by much pain and tension over the injured part ; and by the limb being rendered unable to sustain the weight of the body.

It is often difficult, however, to distinguish fractures of the neck of the femur from dislocations of this bone ; but a due attention to the following circumstances will enable us for the most part to avoid mistakes in regard to this, which are always attended with serious consequences.

In a great proportion of cases, perhaps in ninety-nine of every hundred, the head of the femur when dislocated is pushed inwards and downwards, owing to the brim of the acetabulum being not so deep in this

part as in others ; while in fractures of the neck of the femur, the bone has in every instance that I have seen of it been drawn upwards, and the leg thereby rendered shorter by three or four inches, in consequence of the powerful exertion of the glutæi muscles on a bone deprived of its ordinary support. In all such cases, therefore, the trochanter is found to be much higher than the trochanter of the other thigh ; and the knee and points of the toes turned inwards ; while in those dislocations of the thigh joint that I have mentioned, the leg is much lengthened, the head of the bone is found in the groin, and the trochanter is discovered on the forepart of the thigh, while a corresponding vacancy is perceived where the trochanter and head of the bone should be, and the toes are turned outwards.

In every fracture, a grating noise is discovered on the ends of the bone being rubbed against each other ; and in all fractures of the neck of the femur, we observe, that the leg and thigh may be turned with much more ease from one side to another, that is, the knee and foot may be moved with more ease outwards or inwards, than when the head of the bone is dislocated. I may likewise remark, that, in dislocations, the tumor formed by the head of the bone and trochanter together, must always be larger than in fractures, where the tumor is formed by the trochanter alone.

In no part of surgery are practitioners more apt to be disappointed than in the treatment of fractures of the thigh, particularly where the neck of the bone is broken. This proceeds from various causes ; all of which should be kept in view in forming a prognosis of the event.

1. The thigh bone is so thickly covered with muscles and other soft parts, that it is often difficult to discover the direction in which a fracture runs.

2. We must often, therefore, be uncertain whether the bones are rightly replaced or not ; for where the

course of a fracture cannot be ascertained, we can never be sure whether this is rightly done or not.

3. But even where the reduction of the fracture can be accomplished, we know from daily observation that it is difficult to retain the different parts of the bone in their situation with such exactness as to prevent deformity. For when the fracture is either in the neck of the bone, or runs obliquely in any other part of it, it is so difficult to prevent the fractured parts of it from being displaced merely by the ordinary action of the muscles, that the limb for the most part becomes much shorter than the other; for in all such cases, if the different parts of the bone cannot be so placed and retained as to support each other, the under part of it will very certainly be drawn upwards.

In all these fractures too, other causes concur to render it difficult to retain the fractured parts of the bone in their situation. They are more easily acted upon than fractures of other bones by every exertion of the body; particularly by sneezing, coughing, and laughing; nor can the posture of the body be in any way altered without moving the thigh.

Till of late, practitioners were often disappointed in their endeavours to reduce fractures of the femur; chiefly owing to the position in which the limb was put during the operation. The body being placed either upon the floor, on a table, or in a bed, the limb was then extended, by which all the muscles of the limb were put upon the stretch; and as the extension was continued till the different parts of the bone were replaced, when this was difficult, the muscles were often either violently torn asunder, or so much weakened as not to be afterwards fit for use; for some of the muscles of the thigh being among the strongest of the body, a very considerable force was required to overcome their resistance. But if the muscles of the limb are relaxed, by making the thigh form an obtuse angle with the body while the joint of the knee is moderately bent, it is surprising with what ease we

may, in most cases, place the fractured end of the bone in its situation. The cause of resistance is thus almost entirely removed ; so that if much tension or swelling have not taken place, the ends of the bone may in general be easily brought in contact, by one assistant securing the upper end of it, while the under part of it is supported and gently drawn down by another, the surgeon in the mean time being employed in putting the fractured parts together with as much accuracy as possible.

Fractures of the neck of this bone are particularly difficult to reduce ; for the muscles being here exceedingly strong, and running in various directions, they cannot be relaxed so completely as those in other parts of the limb. But even here we may, for the most part, succeed in the manner I have mentioned, the body being secured by one assistant, while moderate extension is made by another at the under part of the thigh. Practitioners ought, however, to be provided with instruments for more powerful extension when more lenient measures do not succeed. Different instruments are delineated for this purpose in Plates LXXXVII. LXXXVIII. and LXXXIX. but none of them should ever be employed till other more gentle means have failed.

It is not, however, in replacing the bones, but in retaining them when replaced, that we most frequently fail. In transverse fractures of this bone, the practice is easy. After the fractured ends of it are brought in contact, they would for the most part support each other with sufficient firmness even without a bandage, if the patient should be confined to a proper posture ; but to prevent any risk from sudden exertions, the parts should be as firmly secured with splints and a proper bandage, as is consistent with a free circulation through the rest of the limb.

For this purpose two splints are represented in Plate LXXXI. fig. 4. and 6. One to reach from the top of the hip joint to a little below the knee, and of

a breadth sufficient to cover at least one half of the thigh ; the other to reach from the groin to a little below the knee, and in breadth to cover about a third part of the thigh. Of these, covered with soft flannel, the longest laid upon a twelve tailed flannel bandage, is to be placed upon a thin pillow nearly as long as the thigh. The patient being previously laid on a firm hair mattress supported by firm spokes of timber, so that the limb may not sink or yield, his knee being moderately bent, and the bones accurately set, the pillow with the bandage and splint above it ought to be placed so that the splint may reach from the hip joint along the outside of the thigh to the knee. That this posture of the leg and thigh may be easily preserved, the patient should not be laid directly upon his back, but turned somewhat towards the injured side ; and the knee and leg raised rather higher than his body.

The limb being thus placed in the posture in which it is to be kept, the short splint mentioned above must be laid along the inside of the thigh from the groin to the knee, when the twelve tailed bandage, previously placed beneath the other splint, must be applied with such tightness as to make an equal degree of pressure over the whole thigh.

As the cure would be much interrupted, and might even at last be incomplete, were any part of the dressings to yield, it is a right precaution perhaps in every case, to insert a long splint of firm timber beneath the pillow, and to secure it in its situation with two broad straps firmly buckled on the upper part of the limb.

To obviate the motion of the limb, in consequence of involuntary startings, the pillow should be fixed to the bed by straps ; and to prevent injury or uneasiness from the weight of the bedclothes, two or three hoops fixed in a frame should be placed over the thigh.

When no untoward symptoms occur, the limb might be left in this situation till the cure is complete ; but lest the bones should by accident be displaced, and especially if the limb should swell and become painful,

the bandage should occasionally be undone, and the upper splint removed, with a view to admit of the parts being accurately examined ; and the twelve tailed bandage admits of this, without disturbing the limb. When pain, swelling, or much inflammation, supervene, it may be proper to apply leeches and other remedies to the injured parts ; but when this does not happen, and when the bones remain in their situation, the splint should be immediately replaced and secured with the bandage as before.

In healthy adults, when no interruption occurs to it, the cure is in general complete in the course of six weeks ; but violent exertion of every kind should be avoided till the eighth or tenth week has passed over.

I have advised the limb to be placed in such a posture as tends with most effect to relax the muscles that belong to it. But although this may be highly proper at first, there is no necessity for the same posture being continued during the whole course of the cure. It often indeed proves hurtful, as the limb, when kept invariably in one posture for six or eight weeks, as is too frequently done, is very apt to become stiff and unwieldy, so as afterwards to give much uneasiness and distress. In a simple fracture, the patient may, at the end of a fortnight, be allowed to turn more towards his back, and the joint of the knee may be somewhat stretched out. If this is done with caution, it may be repeated daily ; that is, the leg may be alternately stretched out and bent ; by which the motion of the whole limb will be much more free and entire at the end of the cure than we usually find it to be : but where the bones of a limb are broken in several parts, and into small pieces, the limb should not be raised nor moved in any manner of way till five or six weeks have elapsed ; and then only with much caution.

In a great proportion of cases in which cures are practicable, this course of treatment will prove successful. It will never fail in transverse fractures, if all the

parts of it meet with proper attention : but although it will often succeed even where the bone is broken obliquely ; yet it must be confessed, that cases sometimes occur in which it fails entirely ; the ends of the bone slip past each other, and the limb becomes much shorter than it ought to be, notwithstanding all our efforts to prevent it.

An effectual method, indeed, of securing oblique fractures in the bones of the extremities, and especially of the thigh bone, is perhaps one of the greatest desiderata in modern surgery. In all ages, the difficulty of this has confessedly been great ; and frequent lameness produced by shortened limbs arising from this cause, evidently shows that we are still deficient in this branch of practice.

The treatment of fractures being one of the most important branches of surgery, and to prevent lameness, one of our first objects, much ingenuity has been shown in the invention of means for answering this purpose : it has been proposed, and by many attempted, in fractures of the thigh, to secure the patient's body, at one fixed point, with different bandages, to the upper part of the bed, and by an axis in peritrochio at the foot of the bed, to make such a degree of extension as might be fully equal to the purpose of retaining the fractured bones. But all who are acquainted with the fretful, irritable state, in which patients with fractures commonly are, and with the pain that tight bandages always excite, will know, that although proposals of this kind may appear to advantage in theoretical disquisitions, they will never probably be of real utility. And accordingly none of them have ever been in general practice.

The invention of the late Mr. Gooch, of Norwich, is the one that promised to prove most useful in oblique fractures of the thigh. This instrument is delineated in Plate LXXXIII. and in an improved state by the late Dr. John Aitken, in Plate LXXXIV.

A broad firm strap of leather, lined with quilted cotton or soft flannel, is placed on the upper part of the limb, where it is firmly secured with buckles. A similar strap is put round the under part of the thigh, and made to rest chiefly on the condyles of the femur. Two or three steel splints, connected with the straps, pass from one to the other in such a manner, that by means of them the straps can be forced asunder, and retained at any distance during the cure.

For a more particular account of this apparatus, the explanation of the Plates may be consulted.

In some cases, however, the pain, swelling, and inflammation, are so considerable, as to preclude the application of the most simple bandage. After these symptoms are relieved by local bloodletting and other remedies, Mr. Gooch's method, or Dr. Aitken's, may be adopted where the fractured bones cannot otherwise be retained; if not, the cure must be conducted in the usual way, with the hazard of the ends of the bone passing each other, and of the limb being somewhat shortened. But in this event, under the circumstances I have mentioned, although the patient may regret his misfortune, he cannot with justice blame the surgeon.

SECTION XIII.

Of Fractures of the Patella.

THE patella or knee pan is liable to fractures from falls and bruises upon the knee. Transverse fractures of this bone are most frequent: we also meet with longitudinal fractures, and in some cases it is broken into three or four different pieces.

In fractures of the patella, we are desired to make a guarded prognosis; for by most writers, it is said, that they almost constantly terminate in a stiff joint,

owing, as is supposed, to the callus forming in too great quantity, and finding access to the cavity of the joint. I have not found, however, that fractures of this bone are so apt to produce stiff joints as we are led to expect. In various cases that have fallen under my care, scarcely any degree of stiffness remained after three or four months had elapsed; nor is it probable, when permanent lameness ensues to fractures of this bone, that it proceeds from superabundance of callus. I rather think that it proceeds from the inflammation that usually takes place; or from the knee being kept too long in an extended immoveable posture. From a dread of separating the fractured parts of the bone before they are firmly united, the leg is usually preserved in an extended posture for eight, or perhaps ten weeks; a much longer period than is necessary, and by which alone even the soundest joint would be apt to become stiff and immoveable.

In the treatment of fractures of this bone, in whatever direction they may run, the leg should be extended, in order to relax the only muscles with which it is connected, those forming the ligament inserted into it. With this view, the patient should be placed upon a bed rendered so firm that it will not yield during the course of his confinement; a precaution highly requisite in all fractures of the lower extremities, where long confinement to bed is almost always necessary, and where unequal sinking of the body is often the source of much uneasiness to the patient, and may even be the cause of separation of the newly replaced bones.

This being done, a long firm splint of timber, thickly covered with soft wool, or with several plies of fine flannel, should be placed beneath the thigh and leg, from the upper part of the one to the extremity of the other; and to this the limb should be secured by two straps between the ankle and knee, and one or two between the knee and top of the thigh. This will effectually preserve the leg in a state of extension;

and it does it in the easiest manner when the splint is sufficiently broad and properly covered with flannel and wool in the manner I have mentioned.

The different parts of the fractured bone are now to be brought as near together as possible with the hand ; but no bandage is yet to be applied to them. Our great object at first is to prevent inflammation ; for which purpose as much blood should be taken from the joint with leeches as the patient can properly bear ; and for two or three days, or as long as much pain, swelling, or tension, continue, saturnine and other astringent applications should be used for removing them.

This being accomplished, we again examine the state of the bone ; and if the different parts of it are all either entirely or nearly in contact, they ought not to be disturbed. The joint may be covered with a large pledget of saturnine cerate, by which it will be kept soft and easy ; and a hooped frame should be employed to support the bedclothes.

But if the different parts of the bone, instead of being nearly in contact, are found separated to any considerable extent, we ought first to replace them, and then endeavour to retain them as far as this can be done with bandages.

In longitudinal fractures of the patella, this is easily done ; for in this direction we meet with no resistance, and the parts are easily retained by moderate pressure, either with the common uniting bandage, or with slips of leather spread with glue or adhesive plaster. But in transverse fractures of this bone, as that part of it that remains connected with the extensor muscles of the thigh is apt to be drawn forcibly upwards, we cannot always replace it but with a force that would excite pain, swelling and inflammation.

It is not necessary, however, that the different pieces of bone be kept in exact contact. Where it can be easily done, it ought always to be advised ; but I know from the result of several cases where this was

impracticable, that a cure may be obtained, and the joint be equally firm and useful as it was before, even although the separated portions of bone cannot be kept within an inch of each other. We should not therefore be anxious about this ; and instead of using much force for drawing the bones into contact, no more should be employed than the patient can easily bear.

Various bandages have been invented for drawing the divided parts of a fractured knee pan together ; but almost all of them have been formed upon erroneous principles. They are made to press equally upon the upper and under portion of the bone : whereas the least reflection on the anatomical structure of the parts must render it obvious, that no advantage can be derived from much pressure on the inferior part of the bone, which always remains in its natural situation ; and therefore, that our force should be entirely applied to that part of it that remains connected with the ligament of the extensor muscles, by the action of which, particularly of the rectus muscle, this portion of the bone is drawn upwards.

In Plate LXXXVI. a bandage is represented, from which, while it fits easily upon the parts to which it is applied, every advantage may be derived that this kind of assistance can give : it consists of two circular straps of firm leather, A B, lined with soft flannel, with two perpendicular straps C E, that pass from one end to the other, and a semilunar firm compress G ; with another strap of a greater length D, reaching from the point of the toes to the buckle on the upper circular strap round the thigh, as is more particularly represented in fig. 3. of the same plate.

The leg being extended and raised to a proper height for relaxing the extensor muscles of the thigh, the upper edge of the under circular strap A should be applied to the under part of the inferior portion of the bone, so as to support it in its natural situation without forcing it farther up. The strap must be

then tightly buckled ; and the upper half of the bone being pulled gently though firmly down, the femilunar comprefs F in fig. 2. must be applied round the upper end of it, when the upper circular strap must be also buckled. By means of the two perpendicular straps and buckles, we now make a gradual firm extension, which will not move the under circular strap if it was previously made sufficiently tight ; but which will draw the other down if it has not been made too tight. This will, in some degree, draw down the upper part of the bone, by gently pulling the femilunar comprefs previously applied to the upper part of it ; but it will be more effectually done by the strap D made sufficiently tight by fixing it to the corresponding buckle in the upper circular strap B.

In this manner the different parts of the bone may be made to approach each other as far as this can with propriety be done ; but for the reasons I have given already, the pressure should never be carried so far as to endanger the excitement of pain, inflammation, or swelling.

The limb being secured in the manner I have mentioned, the bandages should not be removed till the twelfth or fourteenth day, if pain and inflammation do not render a more early removal necessary. But about this period, the bandage should be removed, when the limb may be moderately bent ; and this being cautiously repeated every second or third day, no interruption will be given to the cure, while the motion of the joint will be preserved ; which it seldom or never is when this piece of attention is omitted.

The joint of the knee is liable to another injury, so similar in its effects, as well as in the method of cure, to fractures of the patella, that I think it right to mention it ; namely, a separation, by external violence, of the ligament or tendon of the rectus muscle from the patella. The usual effect of a smart stroke, or a severe fall, upon the forepart of the knee, is a fracture of this bone ; but where a person carrying a heavy

burden upon his back, falls with his knee much bent, a rupture of the tendon more frequently happens : at least I have met with it in several instances from this cause, in which the tendon, after separating from the bone, retracted to the distance of two or three inches.

The treatment that I have advised for a fracture of the patella proves equally successful here ; only it will be understood, that in this case no advantage can be obtained from pulling down the retracted tendon : for not being connected with any part of the bone, it cannot be laid hold of ; so that we have to trust entirely to the extended posture of the limb. But although the tendon and bone cannot be brought close to each other, yet a cure may always be accomplished in the manner I have mentioned.

SECTION XIV.

Of Fractures of the Bones of the Leg.

IN fractures of the leg, only one bone is often broken ; but a fracture of both is more frequent. In this case the seat, as well as the direction of the fracture, are readily perceived. When one bone only is broken, the nature of the injury is discovered with more difficulty. This, however, is of little importance ; for when one of the bones remains entire, it serves so effectually to support the other, that little more is necessary than confinement till the fractured bone is united.

Fractures are more frequent near the joint of the ankle than in other parts. A great proportion indeed of fractures of the fibula are seated an inch or two above the under extremity of this bone, this being the weakest part of it.

The same general principles that I have proposed in the management of fractures of the thigh bone,

prove applicable in fractures of the leg : in replacing the bones, the muscles of the limb should be relaxed ; and we do it in the most effectual manner by bending the joint of the knee, and slightly extending the foot. The leg being put in this position, the bones are for the most part easily replaced ; and with no more extension than can be easily given by one assistant at the upper end of the limb, and another at the ankle.

This being done, and the patient placed in such a manner that the injured leg may be laid upon its outside, with the knee bent, the splints, figs. 3. 5. or 6. Plate LXXXI. should be applied and retained with the twelve tailed bandage ; the splint on the outside of the leg reaching from a little above the knee to beneath the ankle, with a view to prevent the motion of either of these joints, by which the bones are very apt to be displaced.

Whether the splints are of firm pasteboard, or such as are represented in Plate LXXXI. they would for the most part, prove sufficient : but when the patient is either restless, or troubled with spasmodic affections of the muscles of his leg, an additional splint of wood, shaped to the form of the leg, represented in figs. 1. and 2. of the same plate, should be applied along the outside of it ; and if it is slightly excavated and filled with soft wool or tow, it fits with ease, while it prevents, with certainty, the ends of any of the bones from falling down. We fix it with straps and buckles, and the leg, when dressed in this manner, has the appearance represented in Plate LXXXV. fig. 2.

I have already observed, that after the dressings are applied, the leg should be laid upon its outside, with the knee bent, and the foot supported with a turn of a roller, as represented in the figure just mentioned. The intention of this is to relax the muscles of the limb ; by which the patient lies with more ease, while the bones are less liable to be displaced, than where the muscles are fully stretched out, as till lately was almost the universal custom.

But although the leg should be placed in such a posture as may tend most effectually to relax the muscles; yet the knee should not be more bent than this requires: for when this joint is kept long much bent, it proves almost equally irksome to the patient as when the leg is fully stretched out. The knee should not therefore be more bent, nor should the patient be laid more towards his side, than is just necessary for allowing the leg to be placed upon its outside.

Some people, however, cannot sleep when lying on either side; and some practitioners think, that fractures of the leg heal more easily when the patient is laid on his back, and the limb placed upon the gastrocnemii muscles, with the toes upwards. In such cases the patient may be placed upon his back, and yet the curved position of the leg retained. This may be done in different ways; but the easiest method is, to raise the leg, and support it upon a frame, at a proper height above the level of the body. This admits of the limb being placed in the posture I have advised, and with any necessary degree of curvature.

Even where a fractured leg is placed on the outside, it proves to be a pleasant variety to have the posture altered; and with such a frame it can be easily done.

A limb placed in this situation is represented in Plate XCV. fig. 2, and the same variety of posture is admissible in fractures of the thigh. The patient may from the first be placed with his leg curved in this manner; or he may afterwards turn upon his back, and the cure be completed while he remains in this posture, or he may alternately change from one to the other. The inconveniency usually complained of, from the leg resting upon the heel when stretched out, is avoided by an excavation or opening in the bottom of the frame for receiving the heel, or it may be done by allowing the heel to project over the edge of the frame altogether. No change of posture, however, should be permitted for the first ten or twelve

days. About this time the patient may be turned with caution upon his back, and the leg moved from one position to the other, care being taken to preserve it in the same degree of curvature.

In fractures of the leg, where the fibula only is injured, it is apt to pass unnoticed, and to be considered as a sprain of some of the muscles: but as very serious consequences are apt to ensue from this mistake, it ought to be strictly guarded against.

When treating of fractures of the clavicle, I had occasion to mention an appearance which, of itself, is extremely simple and of easy treatment; but which, from want of attention to the cause of it, has often been productive of much perplexity both to patient and practitioners; I mean what is commonly termed the rising end of a bone; and as this frequently occurs in the leg, I think it proper to mention it here.

When the bones of the leg are broken directly across, they sometimes serve to support each other so effectually that neither of them are displaced. In such circumstances, no inequality appears in the limb, if it be not from some temporary swelling of the soft parts. But when both bones are not only fractured but displaced, the under part of them, or that portion connected with the foot, is almost always drawn down, and towards the back part of the leg; by which an unequal prominency is produced by the projecting end of the upper portion of bone, or that part of it which still remains connected with the knee.

It is this that is termed the rising end of the bone; and in reducing such fractures, much pains is commonly taken to force this part of the bone into contact with the other. It is obvious, however, that the upper part of the bone does not rise, but that the inferior portion falls, or is drawn down, and out of its natural situation, by the weight of the foot, as well as by the contraction of the muscles on the back part of the leg: hence no advantage can be gained by any

pressure made upon the superior part of the bone, while much harm is often done by it, by bandages being so tightly tied over it as to cut all the teguments with which it is covered; and thus forming a compound fracture of what otherwise would have remained of the most simple kind.

The upper part of the bone never rises out of its natural situation; so that any inequality in the form and appearance of the leg, must be produced in the manner I have mentioned, namely, by the inferior portion of the bones being drawn out of the situation which they ought to occupy: so that instead of forcing down the upper part of the bone, our sole object should be to raise the inferior part of it, so as to bring them into contact; and by supporting it in this situation, to endeavour with as much certainty as possible to effect their reunion. In this manner a cure may be often accomplished, which could not be obtained in any other way.

SECTION XV.

Of Fractures of the Bones of the Foot and Toes.

FRACTURES of the bones of the foot and toes are to be managed nearly in the same manner with similar injuries of the hands and fingers. All portions of displaced bone must be put into its natural situation with as much accuracy as possible; and we endeavour to retain them by splints fitted to the form of the part, supported with different turns of a roller. In fractures of the bones of the foot, a large splint should be applied over the sole, so as to support the whole of it; and no freedom should be permitted in the motion either of the foot or ankle during the cure; for nothing tends more to displace a fractured portion of bone than the action of the contiguous muscles.

SECTION XVI.

Of Compound Fractures.

AS the term compound fracture has been applied to injuries of different kinds, I think it right to define with precision the meaning that I wish to affix to it. A fracture of a bone, communicating with an external opening or wound in the corresponding teguments, I denominate a compound fracture. It is not the circumstance of a fractured bone being accompanied with a wound in the contiguous soft parts, that constitutes a compound fracture: this may happen with a fracture of the most simple nature. Unless the external opening communicates with the fracture of the bone, the fracture is not affected by it, even although the wound is extensive; while the smallest puncture passing directly to the substance of a fractured bone, adds difficulty to the method of cure, and hazard to the event.

Compound fractures are produced, not only by external violence, but frequently by the bones in simple fractures being, in the course of the cure, pushed through the corresponding teguments. In some cases, this happens from a bone being so very obliquely fractured that it terminates in a sharp point; while in others it is the evident effect of too tight a bandage, applied with the view, as we have seen in Sect. XIV. of bearing down the upper end of the fractured bone. But in whatever way a compound fracture is produced, the consequences that result from it are nearly similar. The admission of air to a fracture adds evidently to the risk that attends it; and whether this takes place as an immediate effect of external violence, or as the consequence of pressure upon the ends of the bone, no difference is perceived in the effects that result from it.

Various reasons might be adduced to prove that it is the admission of air alone that renders compound fractures more hazardous than others. I may shortly mention, however, one of the most obvious proofs of it. The worst variety of simple fracture, where the bone is broken in the most oblique manner, and where it is difficult or perhaps impossible to retain it in its situation, will continue to do well, and to excite no severe symptoms, as long as the skin remains entire : but if, by any accident, the point of the bone is pushed through the teguments, from that moment the pain becomes more severe ; the inflammation, which before perhaps was trifling, becomes now considerable ; fever takes place ; the limb is apt to be attacked with severe spasmodic twitchings ; and to these gangrene or extensive suppurations frequently succeed.

In the treatment of compound fractures, our first object is to restrain profuse hemorrhagies when they take place, by a proper application of the tourniquet : our next is to consider, whether we should attempt to save the limb, or recommend immediate amputation.

From the difficult treatment and uncertain event of compound fractures, practitioners have been very universally disposed to consider the amputation of the fractured limb as necessary. At all times indeed individuals have opposed this general opinion. Among others, Mr. Bilguer of Berlin wrote decidedly against it ; and he asserts, that amputation is seldom or never necessary, and that a greater number of patients would recover if this operation were entirely exploded.

To me it appears that both opinions are in the extreme ; and that they have been formed without that attention to the discrimination of circumstances which the great importance of the question merits.

In private practice, where patients can be kept quiet and perfectly at rest from the date of the injury, and where due attention can be ensured on the part of the practitioner, as well as of experienced nurses, compound fractures should receive a different treat-

ment from those that happen in a field of battle or in an engagement at sea. So many instances occur, in which, from amputation being objected to by the patient, from the limb being too much swelled or inflamed before assistance is called, or from intention on the part of the practitioner to endeavour to save the limb, of cures being made, that I am now convinced that in private practice immediate amputation should never be advised, unless when the bones are so much shattered that they cannot reunite; or where, from the violence of the injury, the texture of the soft parts is completely destroyed.

On the other hand, I believe, that it would be a good general rule, both in the navy and army, to amputate immediately in all cases of compound fracture that occur in battle, where the accident is either in the humerus or thigh, or where both bones of the forearm or leg are fractured. In this situation, the patient is exposed to a variety of hardships that tend to aggravate his danger; while no accommodation can be procured nor attention given to lessen it.

In opposition to this it may be alleged, that compound fractures are frequently cured in military hospitals. This indeed is the argument on which Mr. Bilguer rests his opinion: but, like every prejudiced inquirer, he states it partially.

I readily admit, as every one accustomed to the treatment of fractures will do, that cures are sometimes unexpectedly accomplished under the most untoward circumstances; but the favourable termination of a few cases will never invalidate an established practice, founded on the sure basis of experience and observation.

When an officer of rank and fortune receives a compound fracture, and where circumstances admit of his being soon conveyed to good quarters, with a prospect of this being his place of residence during the cure, the case must be bad indeed if we do not attempt to save the limb. But this does not happen in

the usual routine of military practice ; and I mention such cases only, because the accounts we have received of Mr. Bilguer's success, are chiefly if not entirely drawn from such instances ; and they therefore afford no general conclusion relative to military and naval practice.

Even in private practice, I am far from thinking that our attempts to save fractured limbs will always succeed. I know that they do not ; and in the course of much business, cases sometimes occur in which the best conducted measures fail, particularly where the large joints are injured, and where the long bones are not only fractured but splintered in different places : but I also know from experience, that where at last we are obliged to advise amputation, more recover when the operation is delayed, than commonly do where it is performed soon after the accident ; at least this has been very commonly the case in the course of my observation. Of those who have died soon after the operation, either from the fever induced by the extensive wound ; from the great and sudden change produced in the circulating system by the removal of a limb ; or from the perturbation and violent agitation of spirits which the unexpected loss of a limb must always induce, a great proportion has been of those on whom the operation was performed immediately after the accident : a patient in this state of body and mind must be ill fitted for undergoing the severity of such an important operation ; and accordingly all the causes that I have enumerated concur to render the subsequent fever, and every concomitant symptom, more violent than we commonly find them in patients who have been reduced by confinement and a low regimen, and who, from having full leisure to reflect upon the danger of their situation, are, from their own conviction of the necessity of the measure, very readily induced to submit to the operation.

A patient may indeed be brought so low as to make the success of the operation doubtful from this cause

alone : but a practitioner may always guard against this, by proposing the operation as soon as his attempts to save the limb prove abortive, and before the patient's strength has declined too much.

Amputation seems to prove more successful in the more advanced stages of compound fractures than immediately after the accident ; and still more so in the advanced stages of chronic affections, particularly in white swellings of the joints, as I have elsewhere remarked, than in the more early periods of the disease. A point of the greatest practical importance is thus offered to our consideration. So far as my observation goes, I consider the fact as ascertained ; and if the experience of others leads to the same conclusion, it will prove the most convincing argument against early amputation. In the course of my own experience, I do not recollect an instance of death having ensued from the operation alone, where the disease was of some duration for which it was advised ; and it has often been performed where the patient was greatly exhausted : whereas many have died merely from the operation, where it has been put in practice soon after the accident. When I speak of death as the consequence of the operation, I do not mean such instances of it as occur from hemorrhagies breaking out in the course of a short time after the patient is laid in bed, as these commonly happen from negligence on the part of the surgeon, at whatever period a limb may be amputated ; but such as take place about the second or third day, and in some instances at a later period, from the violence of the fever induced by and commencing soon after the operation.

When amputation is not performed immediately, or soon after the injury is received, all practitioners agree that it cannot, for several days at least, and often for a much longer period, be admissible. Different causes may afterwards render it necessary.

1. Hemorrhagies under certain circumstances.
2. Extensive mortification.

3. The ends of the fractured bones remaining long disunited, while a copious discharge of matter endangers the strength of the patient.

When hemorrhagies take place immediately, we have it always in our power to command them, either by compression alone, or by enlarging the wound when it is too small, and securing the bleeding arteries with ligatures. Sometimes, however, when no discharge of importance occurs at first, profuse hemorrhagies will take place at the end of several days. It may be difficult in some cases to account for this ; but we can frequently trace it to the effect of friction ; the coats of an artery being destroyed by beating or rubbing upon the sharp edge of a splintered bone.

Even in this advanced state of the injury, we may frequently be able to secure the wounded arteries with ligatures. But the limb is sometimes so much swelled and inflamed before the hemorrhagy appears, that the original opening will not admit of this ; and on proceeding to enlarge it, such confusion is met with from effused coagulated blood between the interstices of the muscles, as well as through the whole cellular membrane of the affected parts, that the divided arteries cannot be all brought into view, but by such extensive incisions as in this state of the parts would create more hazard than amputating the limb at a proper distance above : and although it is not frequent, yet instances happen, where the most expert surgeons are obliged in this situation to amputate.

Mortification is perhaps the most urgent motive for amputating in this stage of compound fractures. I shall have occasion, however, to consider this subject more particularly in the chapter on amputation ; and with respect to the third cause that I have mentioned, no reunion taking place between the fractured parts of the bone, and a sinking of the patient's strength from too copious a discharge of matter, no practitioner of experience will, in this situation, dispute the propriety of amputation.

It is this state of a compound fracture, when the original inflammatory fever excited by the injury is gone, and before the patient is too much weakened by the discharge, which of all others I consider as the most favourable for amputation. The exact time cannot possibly be fixed by any general observation: it must depend upon the particular circumstances of every case, and chiefly upon the quantity of the discharge, and strength of the patient; and these again are points which the judgment of the practitioner in attendance can alone decide upon. I may remark, however, that, as long as the patient does not seem to be much hurt by the discharge, however great it may be, the operation should not be advised; for, while his strength is not much impaired, we may with safety proceed in our endeavours to save the limb.

From what has been said, it will appear, that in private practice, very few cases can occur of compound fractures, in which we should not attempt to save the limbs.

In the treatment of compound fractures, our object is the same as in the management of those of the most simple nature; namely, to replace the bones that may be deranged, and to retain them till they are united.

In the first place, all extraneous bodies should be removed, as well as all those small pieces of bone that will not probably unite with the rest; for which purpose, the opening, if too small to admit of their being easily taken out, should be enlarged with a scalpel. And this being done, we in general find, that the bones are easily replaced by relaxing all the muscles of the limb in the manner already pointed out in the preceding sections of this chapter. Only one exception occurs to this: a sharp point of a bone is, in some instances, so far pushed through the teguments, that it cannot be replaced by an ordinary force; and to a certain extent, the greater the force is that we apply, the more firmly the protruded portion of bone is fixed between the skin and parts beneath. In this situation,

we should either saw off the end of the protruded portion of bone, or enlarge the wound.

When a long sharp point of bone is much protruded, we should not hesitate to remove it; for, although it might be reduced, it would not readily unite with the rest of the bone, at the same time that it would be apt to excite much pain and irritation. When the portion to be taken away is small, it may be done with the cutting forceps usually employed in amputations: but, when it cannot be easily done in this manner, it may with safety be taken off with a saw; a piece of pasteboard, or thin sheet lead being previously inserted between it and the teguments beneath.

But when the protruded portion of bone is broad at the base, and not of great length, as there will be cause to hope that it may unite with the rest of the bone if the corresponding parts are brought in contact, we ought certainly to endeavour to save it; and in general we are able to do so by enlarging the opening through which it has passed. If we take care to avoid any large blood vessels and nerves, which those acquainted with the anatomy of the parts will readily do, no danger will occur from the operation. Instead of increasing the danger of the patient, it tends often to lessen it, by removing a powerful cause of pain and irritation, and thus preventing that inflammatory tension to which limbs in this situation are particularly liable.

To those not accustomed to manage compound fractures in this manner, the practice that I now recommend may be supposed to be attended with hazard; and to convert a small puncture into an extensive wound, may often appear to be cruel and unnecessary. But as the admission of air has already occasioned all the mischief that can arise from this, we do not in this manner add to the hazard of the patient; and it is generally well known, that a free incised wound heals more readily than a small puncture. It is the skin only that for the most part we have to cut here;

but even where the bone cannot be easily reduced without carrying the incision into the substance of the contiguous muscles, we should not hesitate to advise it : only, in this case, the opening should be made as much as possible in the direction of the fibres of the muscles.

The splinters of bone, coagulated blood, and other extraneous bodies being removed, any artery that may be cut being secured with a ligature, and the protruded portion of bone replaced, the fracture is, in other respects, to be reduced in the manner I have advised when speaking of simple fractures ; that is, by relaxing the muscles of the limb, and extending the bones no more than is just necessary. This being done, a pledget of soft lint, spread with any emollient ointment, should be laid over the wound, when the limb should be placed upon a firm splint, and still kept in a relaxed posture. As it is of much importance that the wound be regularly dressed without moving the limb, it should, if possible, be so placed, that this can be done ; and with the same view, the twelve tailed bandage, in compound fractures of the extremities, should be preferred to the roller.

As it is a point of the utmost importance to place the limb in such a posture as will admit of the sore being dressed without being moved, various inventions have been proposed for rendering this in every case practicable. Few of these, however, have answered the purpose for which they were intended. The best that I have seen is a box invented by the late ingenious Mr. James Rae of this place ; of which, with some improvements made by his son Mr. John Rae, I now give a delineation. The leg may be laid in it either bent or straight, and a wound, wherever situated, may be dressed without altering the position of the limb, as will be more clearly understood from the representation of the instrument, Plate LXXXIV. fig. 3.

In whatever situation the limb is placed, it is an object of the first importance to endeavour to prevent

inflammation ; for, when mortification ensues, it may be almost always traced to a high degree of inflammation ; and to this also may be traced those extensive collections of matter which often occur in compound fractures. We are, therefore, from the first, to guard against the accession of this symptom ; by one or more general bloodlettings, proportioned to the strength of the patient ; by the application of leeches to the edges of the fore ; by the use of opiates ; by gentle laxatives ; a low regimen ; and other parts of an antiphlogistic course. The dressings should be removed once or twice daily, according to the quantity of matter ; and instead of dry lint, pledgets of any emollient ointment, or Goulard's cerate, should be preferred ; for I have not found in any state of these sores that ointments do harm ; and they always sit easily, and are more easily removed than when dry lint is applied alone.

Warm emollient poultices are commonly applied at first, and continued for a good many days ; but as they prove always troublesome, and cannot be removed without in some degree altering the posture of the limb, I think it better to avoid them till we see whether or not they become necessary by the approach of inflammation. In that event, they should be immediately employed as the surest means of exciting a discharge of matter : for, although we would rather wish the sore to heal by what is termed the first intention, without the formation of matter ; yet this being a rare occurrence in wounds attending compound fractures, and a plentiful discharge of good pus being the most certain preventive of mortification, we should not hesitate in our endeavours to promote it whenever the inflammation becomes severe.

As soon, however, as our views are accomplished, by the inflammation subsiding, and a free discharge of matter having taken place, the poultices should be laid aside : for when too long continued, they certainly do

harm, by relaxing the parts too much, and exciting too profuse a discharge.

When matter is discharged from compound fractures in too great abundance, besides laying aside the use of emollient poultices, the sore should be dressed with astringents, such as soft lint dipped in a solution of saccharum saturni, with a due proportion of brandy; and the patient should be supported with nourishing food, a free use of wine, Peruvian bark, and elixir of vitriol. A free vent should be procured for the matter; and when this cannot be obtained by the posture of the limb, it should be done by making a counter opening in a more depending part. The necessity, however, of this, may be often prevented by employing soft lint, or covering the sore with soft sponge to absorb the matter, and by frequent dressings; for, although the sores should never be more exposed to the air than is necessary, yet whenever the discharge is copious, there will be more risk from allowing the parts to be long immersed in matter, than from a frequent renewal of the dressings.

When the discharge from compound fractures is excessive, and cannot be lessened by the means I have mentioned, it will often be found to proceed from a portion of loose bone that has not been earlier noticed. In this situation, we should examine the sore with as much attention as possible; and wherever a piece of loose bone is discovered, it ought to be taken out either at the sore itself, or by a counter opening, if it appears that in this manner it can be more easily done. In making an examination for this purpose, the finger alone should be employed when the opening is so large as to give it access; for in this manner we do less harm than with a probe; and at the same time we discover the real state of the parts with more precision. When it is necessary to use a probe, it should be done with caution, for much mischief is frequently done where probes are used with freedom.

If, instead of producing a discharge of matter, the inflammation should end in gangrene, the hazard becomes still greater than it ever can be from the most extensive abscess. Having already, in Chapter I. considered the subject of gangrene, I must now refer to that part of the work. In a following chapter, I shall have an opportunity of mentioning the period at which amputation of limbs, attacked with gangrene, should be advised.

In considering this subject, some will suppose that I should have given more particular directions for securing fractured limbs in their situation, especially in compound fracture; but, as I know of no method of effecting this with such certainty and ease as the one that I have described, I consider it as unnecessary to enumerate all the means that have been proposed for it. In particular circumstances, those that I have described in the eleventh section of this chapter, the machines of Mr. Gooch, and Dr. Aitken, may prove useful for keeping the fractured bones extended; and much advantage may certainly be derived from them in giving a steady support to fractured limbs, when it is necessary to move a patient from one part to another: but in common practice, I can without hesitation say, that no advantage is derived from any instrument of this kind that I have ever known used; and few, I believe, have paid more attention to this branch of business than I have often had occasion to do.

CHAPTER XL.

OF LUXATIONS.

SECTION I.

General Remarks on Luxations.

A BONE is said to be luxated where that part of it forming a joint is displaced. When the end of a bone is forced entirely out of its corresponding cavity, the dislocation is said to be complete; and we term it incomplete, where any part of the bone rests upon the edge of the socket.

Luxations may, with the same propriety as fractures, be divided into simple and compound. Where the end of a bone is merely displaced we term it a simple luxation; but where this is accompanied with a corresponding wound in the soft parts, laying open the cavity of a joint, we say that the luxation is compound. By some practitioners the term compound is applied to dislocations accompanied with fractures of the contiguous bones, whether the teguments be injured or not. We say, however, with more propriety, that a luxation in such circumstances is of a complicated nature.

For the most part luxations are produced by external violence, and appear as the immediate consequences of some considerable force applied to the injured parts. They are particularly apt to occur in leaping and falling; from blows, and from violent twists and distractions of the different bones of a limb: but they are also produced by other causes; by a morbid weakness or relaxation of the ligaments and muscles of a joint, which sometimes occur as the consequences of palsy and long continued rheumatism; and by the end

of a bone being pushed from the cavity in which it was lodged, by matter collected in it, or by tumors and exostoses.

Dislocations produced by external violence, are chiefly the objects of surgery. The symptoms usually induced by these, are, inability to move the injured limb; pain, tension, and deformity in the part affected; and in some cases inflammation, subfultus tendinum, and fever.

In general, the motion of the limb is impaired in proportion to the extent of the luxation; but in some cases, even the most partial luxation renders the joint perfectly stiff and immoveable, and creates the most exquisite pain on every attempt to move it. This is particularly the case in partial dislocations of the large joints.

The deformed or altered appearance of a joint, with which luxations are always accompanied, must necessarily be in proportion to the extent of the injury; but this is not the case with the other symptoms: for subfultus tendinum, inflammation and fever, are often excited in a greater degree by partial dislocations, where the ends of bones are not much moved from their situation, than where they are entirely forced from their sockets, owing to a circumstance that we shall presently endeavour to explain.

The first approach of swelling in dislocation, is always of the inflammatory kind, and it is a necessary effect of the violence done to the injured parts. This, however, should be distinguished from a secondary swelling to which dislocations are liable, an extensive tumefaction that in some cases spreads over all the under part of the limb, and which seems to originate from a different cause. Instead of being red, tense, and painful, the teguments are pale, soft, and œdematous; owing, I suppose, to the lymphatic vessels of the limb being compressed by the end of the displaced bone. This kind of swelling is most frequent in dislocations of the femur and humerus; in which also

considerable numbness or diminished sensibility is apt to take place from the compression of the nerves of the limb.

It is of much importance to distinguish dislocations from other affections of the joints, and to ascertain to what extent the bones are moved from their situation. In compound luxations the nature of the injury is obvious ; and, for the most part, it is sufficiently evident where bones are completely dislocated ; but partial dislocations are often not to be discovered but by the most minute examination : they therefore frequently pass unnoticed, or are considered as sprains, and contusions ; and thus, where, with due attention on the part of the practitioner, a cure might frequently be performed, patients are often rendered lame and miserable for life.

The symptoms that I have enumerated are common to all dislocations. In speaking of particular luxations, I shall have occasion to mention the peculiarities of each, and I shall endeavour to do it in such a manner as may with most certainty prevent those unfortunate occurrences to which I allude.

In forming a prognosis of the event of luxations, that is, of the practicability of their reduction, and of the termination of the symptoms with which they are attended, various circumstances require attention : the form and structure of the different joints ; the nature and extent of the luxation, together with the degree of violence by which it was produced, and the circumstances with which it may be complicated ; and, lastly, the duration of the injury.

The skeleton is commonly had recourse to for a knowledge of the joints ; but although every student should be acquainted with the articulations in a dry state, we should by no means rest satisfied with this. In the treatment of luxations, it is much more necessary to have an exact knowledge of the joints in a recent state ; of the cartilages, ligaments, and tendons,

with which the bones are connected, as well as of the contiguous parts in which the heads of the displaced bones may happen to be lodged : otherwise our ideas of the nature of these injuries, and of the means that will most probably prove successful in the reduction of displaced bones, must be very imperfect.

I cannot here enter upon a minute description of every joint, as it would lead to an extent of discussion inconsistent with the nature of this work. Referring to the proper sources for more particular information, I shall here only observe, that it is chiefly those joints that are possessed of much motion in which we meet with luxations. Of these, there are two varieties. The one termed the junction by ball and socket, where the head or end of one bone is received into the cavity of another ; and the other termed by anatomists *ginglimus*, or the hinge-like joint, from its resemblance to the hinge of a door. In this the joint is formed by different parts of one bone being received into cavities or indentations of another. The former admits of the most extensive motion, as is exemplified in the joint of the humerus with the scapula, and in that of the femur with the *ossa innominata* ; while the latter does not admit of more than that of flexion and extension, as is the case in the elbow and knee. In these we accordingly find, that this more limited motion to which they are confined, renders them less liable to luxations ; while the free motion of the others exposes them to be frequently luxated, as is more particularly the case in the joint of the humerus, from the cavity in which the head of that bone is lodged being of no great depth.

Besides the usual coverings of teguments, muscles, and tendons, in common to joints with the rest of the body, every joint possessed of much motion is provided with what is termed a capsular ligament ; which is a firm somewhat elastic substance, forming a kind of pouch or bag, that completely surrounds the articulation, and serves at the same time to retain the

ends of the bones together, and to contain a thin transparent fluid, the synovia, for the purpose of lubricating the cartilages that cover the ends of the bones.

Practitioners are not agreed whether in luxations the capsular ligaments of joints are ruptured or not. As it has appeared on dissection, in a few instances, that the ligament was ruptured, some have concluded that it is the case in all; while others are of opinion, that the ligament always remains entire, except where the luxation has been the consequence of very severe and unusual degrees of violence.

The result of my observation on this point is, and I speak from many opportunities of dissecting dislocated joints after death, that partial luxations may happen without any rupture of the capsular ligament; but that it is always ruptured in complete luxations produced by external violence; nay, that the ligament is often torn from its insertion round the neck of the bone. Where the head of a bone is gradually pushed from its socket by the slow formation of a tumor within the joint, and where the ligament is perhaps much relaxed by disease, a luxation may happen without either rupture or laceration: but we cannot suppose that such a firm substance as a ligament in a state of health always is, will, without bursting, yield to the sudden impulse produced by the complete dislocation of the head of a bone, and where the displaced bone is in some cases almost instantaneously forced to the distance of several inches from its natural situation. Different instances are upon record of this opinion being supported by the dissection of dislocated joints after death; and were it necessary, I could add several others that have fallen within my own observation.

I mentioned above, that the pain attending partial dislocations is commonly very severe on every attempt to move the joints. For the most part, indeed, it is more exquisite than it usually is where the luxation

is complete ; and we conclude that it proceeds from the capsular ligament being overstretched, and from the ends of the displaced bones continuing to act against it instead of passing freely through it.

In judging of a luxation, the distance to which the head of the displaced bone is forced, and the degree of violence by which it was produced, require particular attention. When a bone is only partially dislocated, although the pain may be very acute, yet the reduction will be accomplished both with more ease and certainty than if the same bone had been forced completely out of its situation. And where the joint has not suffered any extraordinary violence, the inflammation and other concomitant symptoms will not prove so formidable as they commonly do where the capsular ligament and other soft parts have been much stretched, or otherwise severely injured.

One of the most unfavourable circumstances with which a luxation is ever attended, is a fracture of one or both of the bones forming the joint. Even a fracture of the displaced bone proves always distressful, especially if it is broken near to its neck, as in this case it can scarcely be laid hold of for the purpose of reducing it ; but the risk attending it is much greater when the bone forming the socket into which it should be received is also broken : for we know from experience, that fractures of these parts are more apt to excite severe degrees of inflammation, as well as extensive suppurations, than fractures of any of the long bones. And when the socket is broken, there is always much hazard of the joint being rendered stiff for life, even when the reduction of the displaced bone is accomplished in the easiest manner.

A dislocation being more or less recent, is the next point that merits attention ; for we know that luxated bones are, *cæteris paribus*, more easily reduced soon after being displaced than when much time has elapsed. While the injury is recent, the bone returns with more ease along the parts which it has just tra-

versed, than it possibly can do after lodging several weeks or months among the contiguous muscles ; where the head of it, instead of being loose, as is usually the case at first, forms a socket for itself, and is commonly firmly grasped by some of those muscular fibres with which it is surrounded. At this period too, the cavity from whence it was dislodged may probably be in some degree filled up by the contiguous soft parts : not that the synovia ever becomes inspissated, so as to produce this effect ; for although this has by many been supposed to happen, and various means have been proposed for preventing and removing it, yet we now know that the opinion is ill founded. No inspissation of this fluid has ever been discovered by dissection, although stiff joints, where this state of the synovia was previously considered as the cause, have often been laid open for the purpose. But although the cavity of a joint may not be filled up by the effect of any particular affection of the synovia, there is much reason to suppose, that in course of time it will be diminished by the constant action of the contiguous muscles ; which will not only force the cellular substance, fat, and other soft parts with which it is covered, into it, but may even have some effect in compressing the bone itself, or the cartilaginous brim with which the bone is usually covered.

These are the circumstances in dislocations which more particularly require attention ; but we have also to remark, that the patient's age and general state of health, have some influence in the reduction of a dislocated bone. Dislocations are more easily reduced at some ages, and in particular habits of body, than in others. Thus, in advanced periods of life, and in weak delicate constitutions, where the muscles give little resistance, displaced bones are more easily moved than in the vigour of youth, and in robust habits of body, where the superior strength of the muscles has a considerable effect in preventing it.

In the treatment of dislocations, the objects we have in view are, to put the bone that is displaced into its natural situation, with as much ease and expedition as possible ; to retain it in this situation till the injured parts have recovered their tone ; and to obviate pain, inflammation, and any other symptom that requires attention.

Before proceeding to the reduction of dislocations, we should examine the contiguous soft parts, to see whether they are in a fit state for it or not ; for although the sooner the operation is attempted, the more certain will our success in general be ; yet whenever the surrounding teguments and muscles are much contused and inflamed, it is better to allow the pain and swelling to subside before we endeavour to reduce the bone ; at least I have always been in the practice of this. I never observed that any bad consequences ensued from it ; and I have known much mischief done by a limb being stretched while the parts surrounding a dislocated joint have been much swelled and inflamed.

In such circumstances, therefore, we should endeavour, by local bloodletting with leeches, by the use of saturnine applications, a low regimen, and putting the limb in an easy relaxed posture, to remove the inflammation before any attempt is made for reducing the bone.

In almost every dislocation, one bone only is displaced : the other bone or bones of which the joint is formed remain in their natural situation ; and it will be found perhaps universally, that it is the bone connected with the inferior part of a limb that is forced from its situation ; the bone forming the upper part of the joint, if it be not fractured, being seldom in any respect altered : in the reduction therefore of luxations, the only attention to be given to the upper part of a limb, is to keep it firm and steady, while we endeavour by the easiest and most effectual means to replace the inferior part of it.

A person not acquainted with anatomy, might be led to suppose that this may always be readily done; as he will be apt to conclude, that the same degree of force by which a bone is pushed out of its place, will with equal ease replace it. This would no doubt be the case, were it the bone only upon which we had to act, or if the bone was connected with inorganic matter only that would not resist the means employed to reduce it: but every joint being either partly surrounded by, or much connected with muscles, the contractile power with which these are endowed, acts with much force and advantage against every attempt that can be made for the reduction of the bone; for they not only draw it beyond the end of the contiguous bone against which it ought to be placed, but they often pull it out of its natural direction, and fix it firmly in some neighbouring cavity, from whence it is dislodged with difficulty; while the stimulus created by every trial that is made for replacing the bone, is apt to excite a further exertion of the muscles, and to increase the difficulty of the reduction.

It is therefore obvious, that in the reduction of every dislocated bone, the muscles with which it is connected should be put as much as possible into a state of relaxation; for in this situation, the resistance which they give to the force employed for moving the bone is inconsiderable, when compared with what is required for the same purpose, when they are kept in a state of extension. In the one, it is usually done with ease, both to the patient and surgeon; while in the other, that is, while a limb is much stretched or extended, it is with the utmost difficulty that a dislocated bone can be moved.

By relaxing all the muscles of a limb, we may in general obtain a sufficient force for reducing a luxation merely by the hands of assistants; but in some instances more force is required than can be applied in this manner: in this case, various instruments have been proposed for increasing our powers of exten-

sion; some of which, and perhaps the most useful, are delineated in Plates LXXXVII. LXXXVIII. and LXXXIX.

But whether we find it necessary to use machines of this kind or not, no more force should be ever employed than is just requisite; and it ought always to be applied in a slow gradual way, by which there is much less risk of any harm being done, than when the muscles of a limb are forcibly and suddenly stretched: and it will also be understood, that the whole force used for the reduction of a dislocated bone, should be applied to that bone only, and not to any other part of the limb.

Besides the resistance arising from the action of the muscles, we sometimes meet with much difficulty from the projecting end of a dislocated bone having passed that of a contiguous bone. In this case the extension is to be made in such a direction as will best obviate this relative situation of the parts.

In extending a limb for the purpose of reducing dislocations, the extension should be carried so far as to dislodge the displaced bone, and to bring the end of it on a line with the end of the other to which it is to be opposed, otherwise no advantage will be gained by the operation; for while any part of one bone projects past the extremity of the other, no means that we can employ will be able to replace it, unless such a force is made use of, (as has sometimes happened,) as is sufficient for breaking off the projecting part of the bone; while, on the contrary, the reduction is always accomplished in the easiest manner, as soon as the displaced bone is drawn freely past all the projecting parts of the other: nay, when the end of a displaced bone is brought to this situation, it would be difficult to prevent it from passing instantaneously into its natural situation; so that in the reduction of dislocations, our chief object is to make a sufficient degree of extension, when the ordinary action of the muscles will for the

most part replace the bone: or when this fails, the most gentle pressure will prove sufficient.

The dislocated bone being reduced, it seldom proves difficult to retain it in its situation, unless it has often been displaced before: the surest means of retaining it, is to put the limb into a relaxed posture, and to support the bone that has been just replaced with a proper bandage, till the surrounding soft parts have recovered their natural tone.

The symptoms that prove most urgent in dislocations, both before and after the bones have been reduced, are, pain, inflammation, and swelling. For the most part these symptoms abate soon after the reduction; but while any degree of inflammation continues, repeated applications of leeches should be advised as the most effectual remedy: and as this symptom is to be considered as the cause of all the others, as well as of those chronic pains to which joints are liable, that have ever been dislocated, it therefore merits particular attention. But this subject having already been fully considered, when treating of contusions, I must now refer to what was then said upon it in Chapter II. Section II.

In the first part of this section, I have said that luxations are sometimes combined with fractures of the displaced bones. When a bone is fractured at a considerable distance from the luxated joint, we may for the most part be able to reduce the luxation immediately; and this being done, the fracture should be treated in the usual way: but when a bone is fractured so near to the luxated joint that it cannot be laid hold of, the case is thereby rendered both difficult and uncertain. In the smaller joints, as in those of the fingers and toes, the displaced portion of bone may in some instances be pushed into its situation; but in all the larger joints, particularly in the hip joint, and in that of the shoulder, we must first allow the fracture to heal, and the union of the fractured bones to be

perfectly firm, before we can expect to reduce the luxation.

In compound luxations, that is, where joints are not only luxated but laid open by external injuries, the treatment that I have advised in compound fractures applies with equal propriety : almost all the observations indeed that were made upon the one will apply with nearly equal force to the other : so that at present I shall refer to Section XV. of the last Chapter where the subject was fully considered.

I may just shortly observe, that after the luxated bones are replaced, and the limb laid in a proper posture, our next object is to prevent inflammation : this we do with most certainty by copious bloodletting, with leeches applied near to the injured parts ; dressing the sores with saturnine cerate, or any mild ointment ; moderating the pain with adequate doses of opiates ; and a low regimen.

This being done, we have to endeavour to prevent the matter of the sore from lodging about the joint, by placing the limb in such a manner that it may most readily run off : if this fails, we sometimes succeed by dressing the sore more frequently, and absorbing the matter with a bit of sponge ; or, when the quantity of matter is considerable, by a counter opening made in a more depending part of the limb.

When mortification takes place, it is to be treated in the manner I have advised in Chap. I. Sect. IV.

All that I have hitherto said, relates in general to luxations produced by external violence. When they proceed from the heads of bones being pushed from their sockets, either by tumors of a fleshy or osseous nature, or by collections of matter, they may almost in every instance be considered as incurable : when the joint is so situated that the diseased parts can all be removed, this measure should be advised ; but when this cannot be completely accomplished, all that art should attempt is, to give as free a discharge as

possible to any matter that may form, and to support the constitution with such a diet, as may prevent it from being too much reduced by the discharge.

Dislocations are sometimes the consequence of relaxation of the ligaments and tendons by which the bones in a healthy state are kept together. This relaxation is seldom so completely removed as to prevent the bones from falling out from time to time; but the inconveniency may in some measure be obviated by supporting the limb with a bandage; by endeavouring to restore the tone of the relaxed parts by cold bathing; and, in some instances, electricity has appeared to prove useful.

We shall now proceed to speak of dislocations from external violence as they occur in particular parts.

SECTION II.

Of Luxations of the Bones of the Cranium.

THE bones of the cranium are frequently separated from each other at the sutures in hydrocephalus internus. This, however, can seldom become an object of surgery. If such collections shall ever be removed by medicine, all that art can do further is to support the parts with a bandage.

We also find that openings are in some instances produced at the sutures by external violence, particularly by falls from heights. This, however, very commonly proves fatal. I have only met with one instance of a patient under such circumstances recovering. All that in this situation can with propriety be done, is to support the parts by gentle pressure with a proper bandage; to prescribe bloodletting and other evacuations according to the violence of the symptoms; and to keep the patient quiet, and under proper confinement during the cure.

SECTION III.

Of Luxations of the Bones of the Nose.

THE bones of the nose are so firmly united, and serve so effectually to support each other, that they are not often dislocated.

These bones being thinly covered with soft parts, luxations in any part of the nose are easily discovered by the touch, as well as by the deformity which they produce.

In the reduction of luxations of these bones, the patient should be seated opposite to a proper light, with an assistant behind supporting his head; and the surgeon standing before, should endeavour to replace the bones with as much accuracy as possible. In general, this may be done with the fingers alone; but when one of the bones is pushed inwards, we do it more easily by pushing one of the tubes in Plate XXVI. fig. 2. up the corresponding nostril, in order to elevate the depressed piece; and if the tube is guarded with some plies of soft lint, it may be retained in its situation till there is no longer any risk of the bone slipping out.

When either of the bones of the nose is pushed outwards, it must first be exactly replaced, and afterwards retained in its situation by a proper application of a double headed roller.

SECTION IV.*Of Luxations of the Lower Jaw.*

THE lower jaw is connected by a very beautiful mechanism with the bones of the head. In each temporal bone there is an irregular oblong cavity, im-

mediately before the external meatus auditorius. In these cavities, the two condyles of the lower jaw are lodged; and by means of two intermediate loose cartilages which move along with the condyles, and which correspond with the irregular surfaces of the cavities in which they are placed, such a degree of firmness is given to this joint as would otherwise be inconsistent with the freedom of motion of which it is possessed; for although the condyles of the jaw are secured in their situation, by different ligaments, as well as by strong muscles, particularly by the strong tendons of the temporal muscles inserted into the coronoid processes of the jaw; yet the variety of motions which the under jaw is constantly performing, would render it very liable to dislocations, were it not for the intervention of these moveable cartilages; which admit of every necessary freedom, while such a loose, extensive motion is prevented, as must have happened if the heads of the condyles had been placed in large smooth cavities without these cartilages between them.

The under jaw cannot be dislocated either upwards, backwards, or laterally: it can only be dislocated forward and downward. In every other direction, the condyles are so much surrounded with bone, that they cannot be forced out of their corresponding cavities, as will be readily seen on an examination of the skeleton: but when the mouth is widely opened, as happens in yawning, the condyles are apt to slip too far over the anterior boundaries of these cavities. In this manner a dislocation takes place, as we discover by the chin being thrown forward and downward, while the mouth remains open, at the same time that much pain is produced by every attempt to close it; nor can the patient speak distinctly, or swallow but with much difficulty.

In some cases, one side only of the jaw is dislocated, that is, one of the condyles remains nearly in its natural situation, while the other is thrown entirely out.

In this case, the jaw, instead of falling directly down, is pushed obliquely downwards, and somewhat towards the side opposite to that in which it is dislocated.

Besides the symptoms that I have mentioned of pain on any attempt to close the mouth, and difficulty in speaking and swallowing, we are told by all the older writers on this subject, and by all who have copied from them, that luxations of the jaw are apt to induce convulsions, and even death. I have never, however, met with an instance of this, nor is it probable that it will ever happen, unless from great mismanagement on the part of the surgeon.

A luxation of the jaw being very distressful, and even alarming to those who are not acquainted with its nature, immediate assistance is commonly desired; and with due attention we can seldom fail to reduce it.

The patient being firmly seated on a low chair, with his head properly supported behind, the surgeon standing before, with his thumbs sufficiently guarded, should push them as far as they will go between the teeth of the upper and under jaws, the under or flat part of the thumbs being applied to the surface of the teeth of the under jaw: the palm of each hand should be applied to the outside, while with his fingers he lays a firm hold of the angles of each jaw. With the fingers applied in this manner, he should pull the under jaw forward till he finds it move somewhat from its situation: and this being done, but not till then, he should press the jaw forcibly down with his thumbs, and moderately backwards with the palms of his hands; when, if the different parts of the operation are rightly managed, the ends of the bone will immediately slip into their situation; upon which the thumbs should be instantly withdrawn.

In general, we are directed to press the jaw downwards and backwards: but although this might succeed in some instances where the jaw is dislocated on-

ly on one side, yet even there it would often fail ; and it would seldom answer when both condyles are out : for, till the condyles are quite disengaged from the bones on which they rest, and which they can only be by pulling the jaw forward, all the force we could employ in pulling them down would be of little avail, as I have often had occasion to observe.

I have desired, in pressing down the jaw, that at the same time it should be pressed moderately backwards : the slightest force, however, in this direction is sufficient ; nay, in some cases it is not necessary ; for as soon as the condyles are sufficiently depressed, they are almost instantaneously drawn into their natural situations by the ordinary action of the temporal muscles, whether any force be applied for this purpose or not.

The treatment that I have advised answers equally well, whether the jaw be luxated on one side, or on both ; but where one condyle only is thrown out, the force used for depressing the jaw should be chiefly applied to that side.

The luxated jaw being reduced, the patient should be advised to avoid every cause that might have any effect in throwing out the bone again ; particularly much speaking, gaping, and yawning, as the condyles are apt for a considerable time to be turned out by any of these actions.

In the reduction of a dislocated jaw, the thumbs are very apt to be bit if they be not well protected, or if they be not instantly withdrawn on the bones slipping into their situation. For the most part, the end of a handkerchief is wrapped round them ; but a covering of firm leather answers better, or a case of thin iron covered with leather, would be still preferable, as it would not occupy so much space. It would pass farther into the mouth, and would thus act with more advantage in forcing down the jaw.

SECTION V.

Of Luxations of the Head.

THE head is connected in such a manner with the atlas or first vertebra of the neck, that it moves upon it with ease and freedom backwards and forwards, the two condyles of the os occipitis being received into corresponding cavities in the superior oblique processes of that bone : but the lateral and rotatory motion of the head proceeds from the immediate connection between it and the second vertebra of the neck, by means of the processus dentatus of that bone ; which passing through the back part of the large cavity of the atlas, is fixed, by means of different ligaments, to the os occipitis.

The connection between the head and the first of these bones is so firm, that they are not perhaps ever separated by accident ; at least, I have not heard of any instance of this being discovered on dissection. It rather appears, that, in luxations of the head, the connection is destroyed between the head and the second vertebra, the head being forced with such violence forward as to stretch or rupture the ligaments by which the tooth like process of this bone is fixed to the occiput : at least, this has been found to be the case in different instances of these dislocations, and it also happens in those who die by hanging.

In every dislocation of the head, the head falls forward upon the breast ; the patient is instantly deprived of sensibility ; he lies as if he were dead ; and he soon dies if the luxation be not quickly reduced. Injuries of this kind are produced most frequently by falls from great heights, or from horseback.

Luxations of the head, for the most part, terminate fatally ; but as instances have occurred where this has been prevented when timely assistance has been given,

we have reason to think, that recoveries would be more frequent if this could be always procured.

Different means have been proposed for the reduction of these luxations; but whatever requires much preparation is here inadmissible. In all such cases, our views must be instantly carried into effect; and it fortunately happens, that in perhaps every instance they may be accomplished without any preparation.

The patient being seated on the ground, and supported by an assistant, the surgeon standing behind, should raise the head from the breast; and the assistant being desired to press down the shoulders, the head should be gradually pulled straight up till the dislocation is reduced; or, if this does not happen with moderate extension, it may, at the same time, be gently moved from side to side. A sudden noise or crack is heard on the reduction taking place; and if the patient be not entirely dead, an immediate and perhaps entire recovery of all his faculties ensues. In some cases they have been completely restored on the head being replaced; but in others they have remained long impaired, and in some have always continued so.

The reduction being accomplished, the patient should be immediately laid in bed. His head should be kept elevated, and retained by a proper bandage for a considerable time in one posture; and with a view to prevent inflammation, bloodletting should be prescribed in such quantities as his strength will bear; his bowels should be opened with proper laxatives; and he should be confined to a low regimen.

SECTION VI.

Of Luxations of the Spine, Os Sacrum, and Os Coccyx.

THE vertebræ, or bones of which the spine is composed, are so intimately connected, by the process of one bone running into corresponding parts of

another, as well as by strong ligaments and muscles, that they are seldom dislocated. They are so firmly united indeed, that I do not suppose that any of them can be dislocated by external violence without being fractured. Besides the means of connection that I have mentioned, the vertebræ of the back are much strengthened by the support which they receive from the ribs.

I never met with a complete dislocation of any of the vertebræ ; nor do I suppose that it ever happens, even when accompanied with a fracture, but with immediate death : for the force necessary to move one of the vertebræ from its situation, must not only be attended with the compression, but even with the laceration of the spinal marrow, while the contents of the thorax or abdomen must in a very essential manner be hurt by it. I do not suppose, therefore, that a complete dislocation of any of these bones can ever become an object of surgery.

We know, however, that one or more of the vertebræ may be partially dislocated, and that the patient may survive. In some cases, perhaps, a complete cure may be obtained ; but I believe that it does not frequently happen.

These luxations are usually produced by falls from great heights ; by violent blows ; or by heavy weights passing over the body.

They are distinguished, by the body being distorted, by examination with the fingers, and by the symptoms which they induce ; which are such as usually occur from compression of the spinal marrow ; particularly a paralysis of all that part of the body lying beneath the injured part, and either a total suppression of urine, or an involuntary passing of both urine and fæces.

There is reason to suppose, from the mechanism of the parts, that the vertebræ will seldom or never be dislocated outwards : they are usually forced directly forward, or in some degree to the right or left. On

this account they are extremely difficult to reduce, as the contents of the thorax or abdomen must always lie between the injured parts and the means that are used for this purpose.

Various means have been proposed, and different machines invented, for the reduction of dislocated vertebræ. These machines, however, should be laid aside, as being not only useless, but dangerous; for whoever has paid attention to the anatomy of the spine, will see, that in dislocations of the vertebræ, scarcely any advantage is to be gained from the application of much force, while much mischief may evidently ensue from it.

When one or more of the vertebræ are luxated forward, of which we can only judge by an accurate examination with the fingers, the most certain method, perhaps, of reducing the displaced bones is, to bend the body slowly and gradually forward, as far as it can be done, over a cask, or any other cylindrical substance of a sufficient size. If the bone by this position regains its situation, the body should be immediately raised; while the attempt may be repeated when it does not succeed at first.

When the displaced bone is pushed much out of its natural situation, neither this nor any other method will probably succeed; but it has certainly done so in different instances of partial dislocations. In bending the body forward, the two vertebræ lying contiguous to the one that is pushed forward are somewhat farther separated from each other; by which, the displaced bone may, either by the compression produced upon the abdomen, or by the ordinary action of the contiguous muscles, be forced into the situation that it formerly occupied.

When the dislocated bone, instead of being pushed straight forward, is forced in any degree to one side, the body while the reduction is attempting, should not only be bent forward, but somewhat towards the af-

fectèd side ; by which, the two contiguous vertebræ will be separated to a greater distance than they possibly could be by bending it either directly forward or towards the opposite side.

When any part of the os sacrum is luxated, all that can be done is to replace it with as much exactness as possible by external pressure, and by bending the body forward in the manner I have mentioned.

The coccyx is more frequently luxated than any of these bones, as it is equally liable to the same kinds of injuries, besides being more exposed to the effects of falls, and to be injured in delivery.

This bone may be luxated either outwardly or inwardly. It is apt to be forced outwards in laborious births when much violence is used in pulling down the head of a child ; and it has also been displaced by large collections of hard fæces in the rectum. We judge of this having happened, from the pain which takes place all over the region of the loins, particularly about the junction of the os coccyx with the sacrum ; and from the displaced bone being discovered upon examination with the fingers.

When the coccyx is luxated inwardly either by falls or blows, the patient complains of much pain, and of the sensation of a tumor or some other hard body compressing the under part of the rectum ; he is liable to tenesmus ; he finds it difficult to pass his fæces ; and in some instances, a suppression of urine takes place. On the finger being introduced at the anus, the displaced portion of bone is readily discovered.

In outward luxations of the coccyx, we seldom find it difficult to replace the bone by external pressure with the fingers ; but it is often difficult to retain it in its situation. It can only be done by supporting the parts with proper compresses and bandages, for which purpose the T bandage answers better than any other.

In the reduction of an internal dislocation of this bone, the forefinger of one hand, after being immersed in oil, should be passed as far as possible up the rec-

tum. By means of it the bone should be pressed into its situation ; while with the other hand we support the parts outwardly that correspond with it.

As dislocations of these bones, particularly of the coccyx, are very apt to excite inflammation, and as this often terminates in abscesses that do not readily heal, we should omit nothing that may probably tend to prevent it. Bloodletting should be prescribed in proportion to the strength of the patient, particularly local bloodletting with leeches, or cupping and scarifying ; a lax state of the bowels should be preserved ; and the patient should be confined to that posture in which he is easiest, and to a low regimen.

SECTION VII.

Of Luxations of the Clavicles.

THE clavicles are joined to the scapula at the acromion, where they give considerable support to the joint of the shoulder ; and their interior ends are supported by the upper part of the sternum.

As the clavicles are not possessed of much strength, and being tied at their articulations to the contiguous bones by ligaments, they are more exposed to fractures than to luxations. In some cases, however, they are luxated. This may happen at either extremity of these bones, but it is more frequent at their junction with the sternum than at the acromion ; for the force by which luxations of the clavicles are produced, is for the most part applied to the shoulders, by which their opposite ends are most apt to be pushed out.

As the clavicles are thinly covered, luxations of either of their extremities are easily discovered : they commonly produce a good deal of stiffness and immobility in the corresponding joint of the shoulder ; for the neck of the scapula having lost its support, it is apt

to be drawn out of its situation ; by which the motion of every muscle connected with the joint is necessarily affected.

A dislocation of the clavicle is easily reduced by moderate pressure with the fingers, especially if the arms and shoulders are at the same time drawn back ; by which the space which the clavicle should occupy may be somewhat lengthened. It is more difficult, however, to retain the bone in its situation, as it is apt to be again displaced on the pressure being removed, by the ordinary action of the flexor muscles of the arm.

We derive little advantage here from supporting the arm. On the contrary, when the end of the clavicle connected with the sternum is displaced, raising the arm does harm, as it tends to push the bone farther out of its place. It is, therefore, highly necessary to attend to this difference between the management of fractures and luxations of this bone. In the latter, an elevated posture of the arm does mischief : in the former, it proves useful, as I have shewn in Chapter XXXIX. Section V.

The weight of the fore-arm ought however to be moderately supported to prevent the shoulder from being too much drawn down. Besides this, the head and shoulders should be supported, and a moderate pressure made upon the displaced end of the bone. Various bandages have been proposed for this, particularly the long roller applied in such a manner as to form the figure of 8 upon the shoulders and upper part of the breast. No advantage, however, is gained from this, as the bandage cannot be retained so firmly in its situation as to have any effect without impeding respiration. The machine represented in Plate CI. fig. 1. nearly the same as is commonly used for supporting the head, answers the purpose better than any other : for while it necessarily raises the head and keeps the shoulders back, the straps that pass over the upper part of the breast may be made to act with some

force upon the dislocated end of the bone. It is scarcely necessary to observe, that the use of this machine should be continued for a considerable time, otherwise the bone is apt to start, when the whole is to do over again.

SECTION VIII.

Of Luxations of the Ribs.

BY many it has been supposed that the ribs cannot be dislocated; and accordingly this variety of luxation has passed unnoticed by different writers on this branch of surgery. It is only at the articulation of the ribs with the vertebræ that luxations can happen; and being connected with these bones by strong ligaments, they more frequently break than yield at the joints.

It will readily, however, appear, by accurate examination of the junction of the ribs with the vertebræ, that they may be dislocated inwards. They cannot indeed be pushed either upwards, downwards, or backwards; but we know from experience, that a strong force applied near to their articulations, will rupture their connecting ligaments, and thus push them forward; for the fact has been proved by dissection after death.

The symptoms induced by dislocations will be nearly the same with those that ensue from fractures of the ribs, namely, pain in the injured part, with difficult respiration; and if the end of the bone is pushed into the substance of the lungs, emphysematous swellings may ensue from it. A dislocation, however, may be distinguished from a fracture, by the pain being most severe at the articulation, and by no part of the bone yielding to pressure excepting at this very spot.

I believe it will commonly happen, that the end of a luxated rib, in consequence of its elasticity, will return to its natural situation when the cause by which the luxation was produced is removed ; but when it does not, the best method of reducing it will be to bend the body forward over a cask or other cylindrical body, while the vertebræ immediately above and below the rib are pressed inward with as much force as can with safety be applied to them. After this, a thick compress of linen should be laid over these vertebræ, and another long one along the most prominent part of the dislocated rib and the two ribs immediately contiguous ; when, by means of a long broad roller passed two or three times round the body, so much pressure may be made upon the vertebræ as will retain them in their situation ; while the pressure made upon the projecting part of the rib tends to keep the end of it in its situation till the ligaments that were ruptured are again united.

No bandage should be applied with such tightness as to impede the breathing. The best method of preventing the roller from moving, is by the scapulary bandage passed over the shoulder, and a strap connected with it behind, carried behind the thighs and fixed to it before.

No dislocation is more apt to induce inflammation of the contiguous parts, and other disagreeable symptoms ; for the prevention and removal of which, nothing answers so well as copious bloodletting, preserving the patient cool, and at perfect rest, a low diet, gentle laxatives, and opiates if a cough ensues and becomes troublesome.

SECTION IX.

Of Dislocations of the Humerus at the Joint of the Shoulder.

THE joint of the shoulder is formed by what is usually termed a ball and socket, the round head of the os humeri being lodged in a cavity on the anterior part of the scapula. This cavity, however, is so superficial, that in the skeleton it does not appear to contain above a tenth part of the head of the humerus; but in the recent subject it is much more considerable, by means of a cartilaginous brim; and a capsular ligament surrounds the whole joint. By this mechanism, the shoulder enjoys more free motion than other joints; but by this it is also exposed to more frequent luxations; insomuch, that we meet with more dislocations of the shoulder than of all the other joints of the body.

The os humeri is most frequently luxated downwards directly into the axilla, owing to the head of the bone meeting with less resistance in falling into this situation than in any other direction. The head of the bone is sometimes pushed downwards and forward, and lodged beneath the pectoral muscle, when we find it resting on the ribs between the coracoid process of the scapula and the middle of the corresponding clavicle. In a few cases it is dislocated downwards and backwards: but it can never be luxated upwards without being accompanied with a fracture of the acromion; of the coracoid process; or perhaps of both.

The head of the bone, as I have already observed, takes for the most part that direction in which it meets with the least resistance; but this also depends in some degree on other causes, particularly on the part of the joint which received the injury, and on the situation

of the humerus at the time. Thus, if a blow falls upon the upper part of the joint, while the arm is in a direct line with the body, any dislocation that takes place will be downwards; while the head of the bone will most probably be forced downward and inward by any stroke given to the outside of the joint while the elbow is stretched back, and vice versâ.

We judge that the humerus is displaced by the patient being unable to move the arm; by pain being excited on every attempt to press the arm near to the side; by the arm being of a different length from the other; from its being longer or shorter according as the head of the bone is lower or higher than its natural situation in the acetabulum scapulæ; by the head of the bone being felt either in the armpit, beneath the pectoral muscle, or backwards below the ridge of the scapula; and by a vacancy being discovered beneath the acromion. If the two shoulders are examined together, which should always be done, the sound joint will be found round and prominent, while the forepart of the other, if much tumefaction has not taken place, will appear to be flat, or even somewhat hollow. This difference in appearance between the two joints appears most obviously on viewing them both from above downwards.

In luxations of long duration, the whole arm is apt to become œdematous, and to be in some degree deprived of sensibility, from the pressure produced upon the nerves and lymphatic vessels of the arm by the head of the bone. All the other appearances I have mentioned, are likewise so obviously induced by the displacement of the head of the humerus, that scarcely any of them require to be explained. The head of the bone being thrown out of its natural situation, must necessarily affect the action of every muscle of the joint: some will be too much relaxed, while others are overstretched: the motion of the joint must of course be considerably impaired. It is obvious too, that much pain must be excited by the arm being

pressed down to the side, as the head of the bone will not only be forcibly rubbed against some part of the scapula, but the soft parts on which it rests must be greatly compressed, at the same time that some of the contiguous muscles will be stretched to a degree which they cannot easily bear.

In a simple dislocation of the humerus, our prognosis should in general be favourable; for in recent cases we seldom fail in the reduction of the bone. Instances not unfrequently however occur, in which the operation is difficult; but this is seldom the case where it has been properly conducted from the first. In dislocations, indeed, of long continuance, the most expert practitioners often fail; for in such cases, the head of the bone has often formed a socket among the contiguous parts, from whence it cannot be dislodged without tearing asunder some of the muscles with which it is surrounded; and when dislodged, our endeavours may be rendered abortive, by the cavity in which the bone should be lodged being diminished. In all cases, therefore, of long duration, that is, where the bone has been out of its place for six months or upwards; for I have often succeeded where it has been out two, three, and even four months; although it may be proper to make some attempts to replace the dislocated bones, yet none that require great force should be much persisted in, for the attempt must always be of uncertain success, while it necessarily gives a great deal of pain, at the same time that it is apt to render the motion of the head of the bone in the artificial socket, which it generally forms for itself, more stiff than it was before.

In general it is supposed, that the humerus is more easily reduced when the head of the bone is lodged in the axilla than when it is pushed forward beneath the pectoral muscle; but more easily when lodged beneath this muscle than where it is forced back beneath the spine of the scapula. The latter I believe

to be so ; but I have not found in the treatment of the others that there is any difference between them.

In the reduction of a dislocated humerus, we are in general told, that it is to be done by extension, counter extension, and the subsequent application of such a force as is sufficient to replace the bone. These three indications, however, may all be comprehended in one. If a sufficient degree of extension is applied for drawing the head of the bone on a line with the acetabulum, the surgeon will seldom have any thing farther to do ; for when brought to this situation, the reduction is almost in every instance instantly completed by the ordinary action of the muscles.

All that we have to do by counter extension, is to fix the body steadily while the arm is extending, and to prevent the scapula from being drawn forward by the force that is necessary for moving the arm ; for if this bone be not fixed, it in some degree moves forward with the humerus, by which the force employed for extending the arm is in some measure lost, at the same time that the cavity in the scapula in which the head of the bone is to be placed, is thus kept in a state of motion, by which the reduction cannot be so readily effected.

This being done, our powers of extension are applied to the arm, till the head of the bone is drawn on a line with the brim of the socket ; when, as I have observed above, it will instantaneously slip into its place by the action of the contiguous muscles ; so that there is no necessity for the application of any force for this purpose. Much mischief has often been done by force applied with this view, as we shall presently see on considering the different modes of reducing luxations of this joint ; for it is obvious, if the force that is used for raising the humerus is applied before the end of it is drawn past the most projecting point of the scapula, that the two bones must be thus pressed together so as to obstruct the reduction.

Various modes have been proposed for the reduction of dislocated shoulders, inasmuch that we seldom meet with two practitioners who do it in the same manner: but as one or other of these must be preferable to the rest, and as it is of much importance to have this ascertained, I shall offer a few observations upon each of them, and shall more particularly describe that which to me appears to be the best.

1. The humerus is often reduced by pressure with the heel upon the head of the displaced bone. The patient being placed upon the floor, the surgeon also sitting upon the floor directly before him, puts the heel of one foot, that of the left foot when he is operating upon the left shoulder, and vice versâ, upon the head of the bone; and laying hold of the fore-arm with both hands, he extends the arm, at the same time that he endeavours with his heel to push up the bone.

When the head of the bone has fallen directly downward into the armpit, we are directed by some to place a small tennis ball or any other round substance between it and the heel; by which the pressure may be continued with more certainty into the bottom of the axilla than where the heel alone is employed.

This method, however, is liable to three very important objections. By laying hold of the fore-arm, the joint of the elbow is considerably stretched, by which it may be much hurt, while a great part of the force is spent upon it which ought to have been applied entirely to the os humeri: by extending the fore-arm, several of the muscles of the arm itself, as well as the biceps flexor cubiti, are put upon the stretch; by which the extension is rendered much more difficult than when these muscles are relaxed by the joint of the elbow being properly bent. And, lastly, whether the heel be employed by itself or with a ball, it is much more apt to do harm than good; for if it be not applied with such nicety and exactness, as to push the head of the bone directly towards the socket, it must necessarily force it against the neck of

the scapula or some of the contiguous parts, and will thus tend in the most effectual manner to counteract the extension of the arm.

Besides, in this manner, the arm must in every instance be pulled in a very oblique direction downwards by the relative situation of the surgeon and patient; whereas it should in some cases be raised nearly, though not entirely, to a right angle with the body, and kept in that position while the extension is going on.

It may be alleged, indeed, that this method often succeeds, and that it has long been employed by some of our oldest and most experienced surgeons. This I admit: but I also know that it often fails, even with those who speak most favourably of it; and that other modes of treatment have in various instances answered, where this had previously failed.

2. Others attempt to reduce this dislocation, by endeavouring to force the head of the bone into the socket with a rolling-pin applied beneath it, while a sufficient force is employed for extending the arm, and for fixing the body in its situation. With a view to prevent the pin from hurting the skin, we are desired to cover it with flannel, and that part of it which passes into the axilla is directed to be more thickly covered than the rest.

But however this may in some instances succeed, it ought by no means to be received into practice. It is evidently liable to most of the objections I have mentioned to the mode of operating with the heel; particularly to the risk of forcing the head of the humerus in beneath the neck of the scapula, and thus counteracting the force employed for extending the arm. It is obvious, too, even on the principle upon which it is recommended by those who practise it, that this, as well as the mode of operating with the heel, cannot be applicable where the head of the bone is lodged either backward, or forward beneath the pectoral muscle: for the sole intention of both is to raise the head of the bone; and yet by some they are used

indiscriminately, whether the bone is luxated downwards, backwards, or forward.

3. The patient being properly placed, the body fixed by assistants, and the arm extended in the manner I shall afterwards direct, some surgeons make use of a towel or girth for pulling the head of the bone into the socket. The ends of the girth being tied together, one end of the double is put over the arm, and carried near to the head of the humerus; and the other being passed over the neck of the operator, he forces up the end of the bone by raising his neck; and if this could be done with sufficient exactness, just when the head of the humerus has cleared the brim of the socket, no harm would arise from this part of the operation; but if the force for elevating the bone be applied before a sufficient degree of extension is made for this purpose, it must evidently do mischief, by locking the head of the humerus and neck of the scapula together: so that this is in some measure liable to the same objections that I have stated to the mode of operating with the heel and rolling-pin.

These were the means usually employed for reducing luxations of this joint; but being frequently found to fail, others have at different times been proposed in order to increase the powers of extension.

4. Of this nature is the *ambe* of Hippocrates, as it is usually termed: it is the one that was chiefly employed by ancient practitioners, and in some parts of Europe it is still the only instrument used for this purpose: for this reason I have given a delineation of it in Plate LXXXVII. fig. 1. but I do not by any means advise it to be employed. The powers of which it is possessed are great, but they cannot be properly applied; so that they are pernicious in proportion to their extent. It is liable in a tenfold degree to the objection I have stated above to the three preceding modes of reducing this bone, that of pressing the head of it against the neck of the scapula; by which one or other of them must frequently be broken, as will readily

occur to whoever examines this instrument with attention ; for instead of extending the arm before raising the end of it, the first action of this instrument is to raise the extremity of the bone, by which it must be so firmly pushed in beneath the neck of the scapula, as to counteract with much effect the power afterwards applied to extend it.

5. The method of reducing this joint by means of a ladder has been long known, but I hope not often employed. The dislocated arm being hung over the upper step of the ladder, to which height the patient must be previously raised, and being secured in this situation by assistants, the seat on which he is placed is suddenly drawn away ; by which the whole weight of the body falls upon the luxated joint and by which we are told the bone may often be reduced when other means have failed. The top of a high door is sometimes used for the same purpose. Whether the door or ladder is employed, that part upon which the arm is made to rest should be well covered with several plies of soft cloth or flannel.

6. The patient being laid upon the floor, the bone has in some instances been reduced by two or three stout men standing upon a table, and lifting him suddenly up by the luxated arm.

7. Upon the same principle, it has been proposed to raise the patient by the luxated arm with ropes running over pullies fixed in the ceiling of a high roofed apartment. The jerk produced by the body being suddenly raised and let down, has in some cases succeeded where other attempts to reduce the humerus had failed.

This was first practised, I believe, by the ingenious Mr. White, of Manchester ; and I have known it succeed in different cases of old luxations : but these methods are all liable to great objections. The force is too suddenly applied ; by which more mischief may be done to the surrounding soft parts than can be compensated by the reduction of the bone. We know

that muscles, blood vessels, and ligaments, will stretch to a considerable degree, if the extending force be applied in a gradual manner : but we also know, that they very readily break when powerfully and suddenly stretched. Of this we have a remarkable instance in the bursting of the capsular ligaments of joints, which I believe to happen, as I have endeavoured to shew, in almost every case of luxation from external violence. This leads us to say, that any force that is used for the reduction of luxations should be applied in the most gradual manner, and that the mode of operating we are now considering, must frequently do harm by tearing and lacerating the soft parts surrounding the joint. Of this I have had various instances even where the teguments have been protected in the most cautious manner, by covering them with soft flannel, and afterwards with firm leather, before applying the ropes for extending the arm.

Besides, in these modes of reduction, the arm must be always extended in the same direction, whether the bone be luxated forward, downward, or backward : whereas the direction in which the arm is extended, should vary according to these circumstances ; as must be obvious to whoever attends to the anatomy of the parts concerned in the luxation. Nay in one variety of luxation, irreparable mischief may be done to the joint, by extending the arm in a direction which, in another, might not only be proper, but necessary. Where the head of the humerus is pushed forward beneath the pectoral muscle, or directly backward, we may readily suppose that it may be easily reduced by pulling the arm upward, as is done when the body is suspended by a pulley in the manner I have mentioned ; while much harm may be done by it, where the head of the bone is lodged in the axilla, and pushed beneath the neck of the scapula. In this case, the end of the humerus is often so firmly wedged between the scapula and ribs, that one or other of these bones

would necessarily break by the sudden application of much force in this direction ; and it can only be prevented by extending the arm somewhat obliquely downward till the head of the humerus is quite disengaged.

8. A machine has been invented for conjoining the power of the ambe, with the mode of operating we have just been considering ; in which the patient's body is nearly suspended by the dislocated arm, and is suddenly raised and let down again while the operator endeavours with the lever of the ambe to elevate the head of the bone. The invention is ingenious, and the instrument is evidently powerful ; but if our objections to these two modes of operating, taken separately, are well founded, they are no less so when they are combined. The powerful action of the lever must be hazardous in proportion to the uncertainty of its application. While the body is quickly rising and falling, the lever cannot possibly be applied with exactness to the end of the bone ; and if made to act with much force before the head of the humerus is cleared of the scapula, one or other of these must necessarily give way.

9. When the more simple methods of reducing luxations have failed, ropes and pulleys have sometimes been employed. Of these, different forms may be seen in Plate LXXXVIII. figure 2 ; in Scultetus, Plate XXII. fig. 1 ; and in Plate X. fig. 7. of Desagulier's Experimental Philosophy. With one or other of these, any degree of force may be applied that can ever be required for this purpose.

10. But when recent cases are properly managed, luxations may in almost every instance be reduced without any assistance from machinery. I often succeed by the moderate extension I am able to make of the arm with one hand, while the other is employed in pressing back the scapula. This, however, requires all the muscles of the arm and fore-arm to be as much relaxed as possible ; which we accomplish by bending

the elbow moderately, raising the arm to a height somewhat less than a right angle with the body, and preserving it in such a direction as to prevent either the pectoral or extensor muscles of the arm from being stretched. When the arm is in this situation, we often find luxations easily reduced which had previously resisted the greatest force; for in this manner we not only relax the muscles of the arm, but the capsular ligament of the joint; by which the head of the bone returns more readily by the opening at which it was forced out than it otherwise possibly could do. For when the ligament is much stretched, it will grasp the neck of the bone, by which our being able to return it will necessarily be rendered more uncertain.

More force, however, is sometimes required than can be applied in this manner; and the following is a method by which I have never yet failed in recent luxations. The patient is seated upon a chair, and his body secured by a long broad belt passed round it, and given to assistants, or tied round a post: a firm band of leather, four or five inches broad, and lined with flannel, as is represented in Plate LXXXVIII. fig. 3. is now tied round the arm immediately above the elbow. The three straps or cords connected with this band being given to assistants, they are desired to extend the arm in the relaxed position I have mentioned, and in a slow equal manner, while another assistant standing behind is employed in keeping the scapula firm. The surgeon himself stands most conveniently on the outside of the arm: his business is to direct the assistants in the degree of force they are to employ, and to point out the direction in which the arm is to be extended; he may also support the fore-arm and retain it bent at the elbow, in the manner I have mentioned. As soon as the head of the bone is drawn clearly past the brim of the socket, the extension of the arm should be somewhat relaxed, when the reduction will for the most part be accomplished by the

action of the muscles of the joint ; or it will be readily effected by moving the arm gently in different directions. A crack is heard on the bone slipping in ; the patient finds immediate relief ; and the anterior part of the shoulder acquires its usual prominent form.

The direction in which the arm is extended, must depend upon the situation of the head of the bone : that in which it will meet with the least resistance is always to be preferred. When the head of the bone is pushed forward, and lodged beneath the pectoral muscle, the arm should be raised to a right angle with the body, and the same direction will answer where it is pushed backward ; but in the most frequent kind of luxation of this joint, where the head of the bone is lodged in the armpit, the arm should uniformly be drawn somewhat obliquely downward : if extended when raised to a right angle with the body, it would be drawn against the neck of the scapula, by which much pain would be excited, and the reduction frustrated. Of this I have seen many instances, as every practitioner must have done.

It should be a general rule in the treatment of every luxation, to vary the direction in which the extension is made as soon as any considerable resistance is met with ; but in luxations of the humerus, attention to the observations I have just thrown out will for the most part prove sufficient.

In reducing luxations of this joint, it has been the prevailing practice to press the scapula forward and downward : nearly the reverse of this, however, should be adopted. By pressing the scapula downward, we force it against the head of the humerus, the very thing we ought most carefully to avoid : and by forcing it forward, it is evident that the end of the humerus will not be so easily drawn out from beneath it, as when the assistant is desired to pull it backward in the manner I have mentioned.

II. The mode of treatment I have just been describing, will succeed in almost every instance of recent

luxation; and it will seldom fail even in cases of long standing, where the reduction of the dislocated bone is practicable: but when a greater force is required than can be applied in this manner, the instrument represented in Plate LXXXIX. may be employed. It was invented by the late Mr. Freke, of London; and it answers the purpose of extension better, and with more exactness, than any that I have seen. It is delineated exactly from the plate given of it by Mr. Freke; but it admits of some improvements. The strap A A which passes over the shoulder, presses down the scapula, and thus impedes the reduction of the bone: it should therefore be either entirely wanting, or made with a slit to pass over the arm so as to draw the scapula back: in which case, instead of passing obliquely downwards to be fixed in the floor, it should pass straight across, and be fixed in a post on a line with the shoulder.

I have already observed, that the use of a lever in raising a luxated humerus is both unnecessary and dangerous: the lever of this instrument, therefore, instead of being moveable, should be fixed so as only to serve as a support to the arm; or if it ever is used as a lever, it should be managed with the utmost caution. The principal advantage that we derive from this instrument, is our being able, by means of it, to apply any force that may be necessary in the most gradual manner; an object of the first importance in the reduction of luxations: it also extends the arm in any direction we may judge proper; by which it can at once be adapted to any variety of luxation.

Swelling, pain, and inflammation, when they occur as consequences of luxations of the arm, are to be removed by the remedies usually employed in such cases, but chiefly by local bloodletting with leeches.

The round head of the biceps flexor cubiti, which passes through the joint of the shoulder, and is lodged in a groove in the head of the humerus, is apt to be separated from this bone when it is forced far out of

its natural situation, and thus induces a stiff unwieldy state of the arm: for the most part it returns immediately to this groove on the dislocation being reduced; so that there is commonly cause to suspect that it continues to be displaced when any unusual pain, stiffness or tension remain. The most certain method of replacing it is to move the arm from time to time in every variety of way; and we know that it is replaced, by an instantaneous removal of the distress.

The glenoid cavity of the scapula being very superficial, the head of the humerus is apt to fall out again, even after it has been completely replaced; particularly when it has been frequently luxated. The most certain method of preventing this is to support the arm in a sling, as is represented in Plate XCVI. fig. 2, till the parts recover their tone. Blisters applied to the shoulder, and pumping cold water over the joint, have also proved useful for this purpose.

SECTION X.

Of Luxations of the Fore-arm at the Joint of the Elbow.

THE bones of the fore-arm at the elbow are more frequently dislocated upward and backward than in any other direction: they can scarcely be luxated laterally or forward, if the injury be not at the same time accompanied with a fracture of the olecranon or top of the ulna, as will be readily perceived on examining the connection of that process with the cavity in the posterior part of the os humeri.

As the joint of the elbow is not deeply covered with soft parts, luxations of the bones are easily discovered as long as swelling and tension have not taken place. When these symptoms occur to any extent, it is often difficult to distinguish either the na-

ture or extent of the injury with which they are connected. When the luxation is backward, the olecranon is felt on the back part of the arm, and the condyles of the humerus are pushed forward. When the olecranon is broken off, and the ulna and radius pushed forward, they are also apt to be drawn upward on the anterior part of the humerus, when the condyles of that bone are discovered behind. The extent of the joint is so considerable from one side to the other, that the bones composing it can never be completely luxated laterally, unless the soft parts with which they are covered are much lacerated. In whatever way they are displaced, the joint becomes immediately stiff and immoveable.

In the reduction of these dislocations, the patient should be seated on a chair of a convenient height, and the arm firmly secured by an assistant : when the bones are luxated backward, the fore-arm should be moderately bent, in order to relax the flexor muscles : while in this position it should be slowly and gradually extended ; and if care be taken to increase the curvature of the elbow in proportion as the extension is made, we seldom or never fail to complete the reduction. Where the olecranon is broken off, and the ends of the radius and ulna pushed forward and drawn up upon the humerus, we are under the necessity of extending the arm while in a straight position, as in this case the heads of these bones are pushed back upon the anterior part of the humerus on the least attempt to bend them. The extension should be continued till the ends of both bones are pulled somewhat lower than the most depending point of the humerus, when they will either regain their situation by the action of the muscles, or be easily forced into it.

In lateral dislocations of these bones, the extension must also be continued till they have clearly passed the end of the humerus, when by moderate lateral pressure they will for the most part be easily replaced. Of whatever kind the dislocation may be, the extension

should be made by assistants grasping the arm immediately above the wrist ; and while they are thus employed, much advantage may be gained by the surgeon pressing down the heads of the bones.

In two cases of dislocation of these bones, where their heads were drawn up upon the back of the humerus, the reduction was not accomplished, although a great force was applied, not only in pulling at the under part of the arm, but in pushing down the heads of the displaced bones. In one of them, where the olecranon was pushed through the teguments, that part of the bone was sawn off, by which the reduction was effected : in the other, this expedient was not advised ; and the practitioner finding all his efforts to reduce the bones prove abortive, the limb was amputated. As the extension in both was applied while the arm was stretched out, and as I have never failed in similar cases where the arm was bent, I conclude, that in the one the arm would have been saved, and in the other the joint preserved entire, if this practice had been adopted.

The reduction being completed, the fore-arm should be kept in a relaxed position, by keeping the elbow moderately bent.

These bones, when reduced, do not readily fall again out of their place ; but it is proper in this, as in every case of luxation, to preserve the limb as much at rest as possible till the injured parts have recovered their tone.

The bones of the fore-arm are also liable to be dislocated in their connection with each other. At the joint of the elbow a projecting part of the radius is lodged, and moves in a corresponding cavity of the ulna ; and below, a portion of the ulna is received by a similar cavity in the radius. Instances have occurred of these bones being separated from each other at both these points of connection ; but any separation of this kind is more apt to happen at the wrist than at the elbow. It is known to have occurred, by all the

usual signs of luxations : by pain, swelling, and distortion in the injured part ; by the motion of the joint being impaired ; and by manual examination.

In general, the displaced bone is easily put into its situation ; but for the most part we find it difficult to retain it. The most certain method of effecting this, is, to put a long firm splint along the outside of the arm from the elbow down to the points of the fingers, and another of the same length on the inside ; the whole to be secured with a flannel roller, and the arm hung in the sling represented in Plate XCVI. fig. 2. By this we prevent the rotatory motion of the radius, and the pronation and supination of the hand ; and if this is guarded against for a sufficient length of time, a cure may at last be expected, while want of attention to this is frequently the cause of the joint at the wrist remaining stiff for life ; of which I have met with various instances.

SECTION XI.

Of Luxations of the Bones of the Wrist.

THE bones of the wrist are not so frequently luxated as might be expected from the smallness of their size, owing to their being firmly connected by ligaments ; as well as to the strength which they derive from the whole tending to form a kind of arch ; the convex part of which being on the outer or back part of the hand, where it is most exposed to injuries, is particularly well calculated for preventing any of the bones from being displaced.

Degrees of force, however, are sometimes applied to them which they are unable to resist. From their form, it will appear, that they will most readily be dislocated outward. The three superior carpal bones, which form a kind of projecting head, that is lodged

in a superficial cavity in the under extremities of the ulna and radius, may either be dislocated at this joint, or they may be separated from the five inferior bones of the wrist. In some instances, one or more of these bones are separated from each other; and in others they are dislocated at their connection with the bones of the metacarpus and the superior bone of the thumb.

As these bones are not thickly covered with soft parts, the nature of the injury becomes immediately obvious: but in some cases, where perhaps a single bone is only partially displaced, if the parts be not examined with attention, the symptoms that occur are apt to be attributed to a sprain; and the real cause of them being overlooked, a permanent lameness is thus induced, which with much ease might have been prevented. Of this I have met with various instances. Similar occurrences, however, may always be prevented by an early and attentive examination of the injured parts.

In reducing luxations of these bones, we are in general desired to stretch the arm and hand upon a table, and while they are in this position, to push them into their situations: but it is better to have the arm and hand supported by two assistants, as in this situation the surgeon gets ready access to both sides of the wrist. The assistants should be desired to keep the parts sufficiently firm, but not to stretch them; and when in this situation, the surgeon will seldom find it difficult to push the bones into their places. They must be retained by splints and bandages in the manner mentioned in the last section; and as dislocations of these bones are very apt to induce inflammation of the ligaments and other contiguous soft parts, repeated applications of leeches should be advised as the most certain preventive.

SECTION XII.

Of Luxations of the Bones of the Metacarpus and Fingers.

WE have seen in the last section that the metacarpal bones may be dislocated at their junction with the bones of the wrist; and they are sometimes displaced at their under extremities, where they are connected with the bones of the fingers. They are not so frequently luxated, however, as at first view might be expected; probably from the joint of the wrist being so moveable, that the whole hand readily yields to any force that is applied to it.

The bones of the fingers and thumb are also sometimes luxated; but we likewise consider the mobility of these bones as the principal reason of their being less frequently dislocated than many of the largest and strongest bones that are more firmly connected together.

Dislocations of these bones are easily discovered by all the usual symptoms of luxations; but particularly by the deformity which they produce, which in this situation is always conspicuous.

When any of the metacarpal bones are displaced at their connection with the bones of the wrist, the best method of reducing them is, by keeping the arm steadily fixed, and pushing them from above downward, while the hand remains loose and moveable. When the first phalanx of any of the fingers is moved from its junction with the corresponding metacarpal bone, it is to be replaced by one assistant fixing the hand, while another draws down the dislocated finger, which should be done by grasping the first phalanx only, in order to prevent the other joints of the finger from being hurt. Dislocations of all the other joints of the

fingers, as well as of the thumbs, are to be managed in the same manner.

In the reduction of these dislocations, the bone should not be pulled down till it is somewhat raised or elevated from the contiguous bone ; for as all the bones of the fingers and thumbs, as well as those of the metacarpus, are thicker at their extremities than in any other part, these projections are apt to be forced against each other when the extension is made in a straight direction. In this manner the greatest force has frequently been employed in vain ; nay, fingers have been amputated where this alone prevented luxations from being reduced, and in which a very inconsiderable force would have proved successful, if the displaced bone had been somewhat separated from the other before any force was applied for extending it.

SECTION XIII.

Of Luxations of the Femur at the Hip Joint.

THE socket or acetabulum, formed by the ossa innominata, for lodging the head of the thigh bone, is so deep ; the brim of the socket in a recent subject contracts so much about the neck of this bone ; the head of the bone is so firmly tied down to the bottom of the socket by a strong ligament ; and it is so confined by strong muscles, that we would not à priori suppose that it could be luxated by external violence : we would rather imagine that it would break at the neck where it is weakest, than that the head of it should ever be forced from its socket : this opinion has accordingly been adopted by many in all ages. For a considerable time I was disposed to favour it, from having observed several cases which at first were supposed to be luxations, but which proved to be fractures of the neck of the femur. In the course of the

last few years, however, I have seen several cases in which I was convinced that the thigh bone was luxated. The nature of the symptoms gave reason to imagine that they arose from luxations; and they were proved to do so by the patient's being instantaneously and completely relieved, and rendered quite able to walk, on the head of the bone being replaced; which in a fracture of the bone could not happen.

In treating of fractures of the thigh bone, the circumstances by which fractures of the neck of it may most readily be distinguished from luxations, were mentioned: I shall therefore refer for this part of our subject to the eleventh Section of the preceding Chapter.

It is said by authors, that the head of the femur may be luxated in various directions, namely, upward and backward, upward and forward, downward and backward, downward and forward, and I may add directly downward. That all of these may happen, I cannot take it upon me to deny; but I believe few practitioners have met with an instance of the first and third. The second variety, where the head of the bone passes up upon the os pubis, may happen; as may likewise the last, where it is forced directly down; but I have never seen any variety of this luxation if it be not that in which the head of the femur is pushed downward and forward, and lodged in the foramen ovale. All practitioners admit, that the bone is most frequently dislocated in this direction; and an examination of the skeleton, as well as of the recent subject, will show why it should be so. The brim of the socket over all the upper and back part of it, is not only stronger, but more elevated than the rest of it. It falls away as it descends; and on the anterior under part of it there is a considerable vacancy in the bone, the space being filled with a ligament only; and as this opening is sufficiently large to admit the head of the femur, we easily see how luxations should be most apt to occur here.

Every luxation of the femur must be productive of lameness, and of pain, tension, and other symptoms with which other luxations are accompanied. When the head of the bone passes upward and backward, the leg must be much shorter than the other ; inasmuch that the points of the toes only will touch the ground when the patient is standing upon the other foot ; the great trochanter of the thigh bone will be higher than in the other side ; the knee and foot turned inward ; and a good deal of pain must be induced by every attempt to turn them out.

When the femur is luxated upward and forward, the leg must be shortened ; the head of the bone will be felt resting above the os pubis in the groin ; the great trochanter will be on the upper and anterior part of the thigh near the groin, while a vacancy is discovered in that part of the hip which it ought to occupy ; the knee and toes will be turned outwards ; and if the dislocation be not soon reduced, pain, tension, and inflammation, will occur in the spermatic cord and testis, from the pressure made upon the cord by the head of the bone.

If ever this bone is luxated downward and backward, the leg will be considerably longer than the other ; the knee and toes will be turned inward ; and the great trochanter will be much lower than the same protuberance of the other limb. When the head of the bone passes directly downward, the leg will also be longer than the other, and the trochanter will likewise be lower ; but the knee and toes will retain nearly their natural situation ; only every attempt to move them will be productive of pain.

In the most frequent luxation of the femur, the leg appears to be considerably longer than the other ; the knee and points of the toes are turned outward, nor can they be moved either farther outward or inward but with much pain : all the muscles in the internal part of the thigh are tense and painful ; the femur cannot be felt on the outside farther up than the middle

of the thigh ; a vacancy is discovered in the usual seat of the great trochanter, which is found farther down and on the anterior part of the thigh, while the head of the femur is plainly felt a little below the groin ; being seated, as I have observed above, in the foramen ovale.

In luxations of the femur, the difficulty and uncertainty of reducing them has been considered as so great, that in general we have been advised to give a very doubtful prognosis of the event. In cases of long duration, this should always be done : for besides other causes which add to the difficulty of reduction, the muscles here are so strong that they resist, in the most powerful manner, every attempt to dislodge the head of the bone after it has been long fixed among them : by contracting round the neck of the bone, they must even be torn asunder before it can be reduced : but in recent luxations we have not this difficulty to encounter ; and we know that with proper management the bone may in almost every instance be reduced.

The reduction of this bone is commonly attempted by pulling the limb downward ; and it seems to be an opinion very universally received, that any force we employ should be applied in this direction. Some advise the limb to be drawn directly down from the part in which the head of the bone is lodged ; others desire it to be pulled exactly in a line with the hip joint, while others turn the knee somewhat inward. The patient being placed upon his back, and properly secured, the limb is extended in one or other of these directions, either till the reduction is accomplished, or till such a force is applied as makes the operator afraid of doing harm were he to proceed farther.

It must be allowed, that dislocations of the femur have in various instances been reduced in this manner : it might often succeed where the head of the bone is forced upwards ; but I may without hesitation assert, that even in this case the reduction might be effected with less force in a different manner ; and in a great

proportion of cases, where the head of the bone is lodged in the foramen ovale, or where it is forced directly downwards, that we must necessarily fail entirely by confining the line of extension to any of the directions I have mentioned.

In whatever way the head of the femur is luxated, it must pass over some inequalities or prominent parts of the contiguous bones: these it must again pass over before it is reduced; at least this must be the case if we wish it to return by the same route, and it will be admitted in the treatment of luxations to be a good general rule, to endeavour to replace the bone by the opening at which it passed out. But where the limb is only pulled downward in the usual way, the head of the bone will be forced against the projecting brim of the socket, if the dislocation is upward; or it will be drawn to a still greater distance from the joint where the bone is dislocated either directly downward, or lodged in the foramen ovale in the upper and inner part of the thigh. Wherever the head of the bone may be lodged, it should be completely raised above any projecting part of the contiguous bones before any other attempt is made for reducing it. As this will remove the principal impediment to the reduction, if the muscles of the limb are at the same time relaxed, it will easily be drawn into the socket when the dislocation is upward, or pushed into it where the head of the bone is already beneath it.

In the most frequent variety of this luxation, where the head of the bone is pushed downward and forward, I have succeeded in the following manner: the patient is laid upon his back across a bed, and firmly secured by two or three assistants: a broad strap, or table cloth, properly folded, is passed between his thighs, and over the groin on the sound side, and given to two other assistants: a similar strap is passed round the luxated thigh as near as possible to the head of it; the ends of which must be given to an assistant standing on the opposite side: the belt represented in

Plate LXXXVIII. fig. 3. being previously fixed upon the under part of the thigh, the straps connected with it are given to an assistant or two, while the knee is supported by another assistant with the leg moderately bent. The thigh is now to be moderately stretched by the assistants who have the charge of the straps at the under part of it; but the extension should not be carried farther than what may be considered as necessary for drawing the head of the bone down to the under part of the foramen ovale; and this may be always done with a moderate force. The strap round the top of the thigh must now be firmly pulled by those who have the charge of it; who, standing somewhat higher than the patient, should draw the thigh upward and inward; and the extension should be continued in this direction till there is reason to suppose that the head of the bone is clearly raised from the foramen in which it was lodged. At this time the person who has the charge of the knee should be desired to move it somewhat inward, and to push the head of the bone upward and obliquely outward: he will do this with the greatest certainty of success, if he secures the knee with one hand, and the foot with the other, at the same time that he takes care to keep the leg just so much bent as may relax all the flexor muscles without stretching the extensors. If the different assistants perform their parts properly, the first attempt will answer; but if any of them have failed, particularly if the head of the bone has not been sufficiently raised from the hollow in the foramen ovale before being pushed upwards, the attempt must be repeated.

As the head of the bone may for the most part be felt outwardly, the surgeon may in general ascertain with certainty whether it is sufficiently raised or not. If he finds it rise easily, the force may be continued till it appears to be about an inch higher than when it was first applied; while, on the contrary, if it yields with difficulty, there will be reason to suspect that

some part of the head of the bone is fixed or locked in the upper part of the foramen ovale ; in which case the force in this direction should be discontinued, and the other assistants at the knee being directed to increase the extension downward, it will afterwards be more easily raised.

In whatever direction the bone may be dislocated, the point requiring most of our attention, is the raising the head of the bone sufficiently before any attempt is made to force it into the socket. This being accomplished, a very slight force will in general draw it down when the dislocation is upward ; and when dislocated downward, whether it is somewhat backward or directly on a line with the socket, it will be easily pushed up.

In this manner recent luxations of this joint may for the most part be reduced ; and the same treatment is perhaps the best even in luxations of long duration. In these it will sometimes fail ; but it will succeed, I believe, as frequently as any other that has yet been proposed, while it is not productive of the dreadful pain that commonly ensues from the use of those machines that have been invented for a greater extension of the limb. When any additional force, however, is judged necessary, it may either be obtained by a proper application of Mr. Freke's machine, represented in Plate LXXXIX. of Mr. Petit's in Plate LXXXVII. fig. 2. or of the pullies and ropes represented in Plate LXXXVIII. fig. 2.

It should be remarked, however, that this kind of assistance can never be applicable where the luxation is downward. Extension of the limb having been considered as necessary in every variety of luxation, it has often been indiscriminately employed, whether the head of the bone was placed above or below the socket : it is obvious, however, that it is in the former only that it can ever prove useful ; and in the latter, that much mischief may ensue from it.

The violent distension of the muscles, and extensive laceration of the articular ligaments, with which luxations of this bone must always be accompanied, render much care and attention necessary long after the reduction is accomplished. Local bloodletting with leeches, or cupping and scarifying, proves particularly useful here, and should be repeated more or less frequently according to the violence of the symptoms, and age and habit of the patient; and till the parts may be supposed to have recovered their tone, the patient should be kept as much at rest as possible.

By many it is imagined that the femur may be partially luxated; and the appearances which are supposed to arise from what is termed a subluxation of this bone are described by authors: of these, however, I have taken no notice, as it is not my opinion that this bone can ever be partially luxated. The head of it is so round, and the brim of the socket so narrow, that whoever examines them will be convinced that it cannot happen. The head of the bone may, in a gradual manner, be pushed out of the acetabulum by a tumor at the bottom, but I do not suppose that it can ever occur from external violence.

SECTION XIV.

Of Luxations of the Patella.

THE patella may be either partially or completely luxated, and it may be displaced either upward or downward, outward or inward: it may also be luxated by itself, or it may be displaced along with the tibia and fibula in luxations of these bones. It cannot, however, be completely luxated in any direction, if it be not accompanied with a rupture of the ligament by which it is tied to the tibia, or of the ten-

don of the rectus muscle connected to the upper part of it ; and it will be more readily dislocated inwardly than in any other direction, owing to the internal condyle of the femur being somewhat less prominent than the other : for as this bone is placed in some degree between these condyles, it will necessarily be most easily forced out at that side where it meets with the least resistance.

Luxations of this bone are, for the most part, easily discovered, as it is thinly covered with soft parts : but when it has been long displaced, it is apt to induce so much tumefaction, not only about the joint, but over all the contiguous parts, as to be distinguished with difficulty. Even the most partial luxation of the patella always gives considerable lameness and much pain on every attempt to move the joint.

In the reduction of a luxated patella, the patient should be placed either on a bed or on a table, and his leg should be stretched out and kept in this posture by an assistant. The surgeon should now lay hold of the bone, and endeavour to push it into its situation ; but instead of pushing it directly forward, it should first be somewhat raised, otherwise we are apt to force it against the condyles of the femur or head of the tibia. The best method of effecting this is to press down the side of the bone most distant from the joint ; by which the opposite side of it will be elevated, when a very moderate force will press it into its place. When the patella is drawn out of its situation by the tibia and fibula being displaced along with it, it cannot be replaced till the reduction of these bones is accomplished.

SECTION XV.

Of Luxations of the Tibia and Fibula at the Joint of the Knee.

THE tibia is the only bone of the leg that is immediately concerned in the joint of the knee ; but as this bone cannot be dislocated without drawing the fibula along with it, I think it right to mention them together.

As more strength is required in the knee than in any other joint of the body, the bones of which it is chiefly formed, the femur and tibia are connected together by the strongest kind of articulation, namely, by ginglymus or the hinge like joint : the surfaces of the two bones are very extensive, and they are firmly tied together by strong ligaments : there is also reason to suppose, that the moveable cartilages placed between the ends of these bones have some influence in lessening the friction of the joint, and in thus rendering it more firm than it otherwise would be.

The great strength of this joint is the reason of its being less frequently dislocated than any other in the body : it cannot indeed be completely dislocated but by the application of so much force as will not only rupture the teguments which cover it, but the strong ligaments and tendons which tie the bones together. As this requires a very unusual degree of violence, these bones are seldom forced entirely past each other ; and the same reason even prevents them from being often partially luxated. When either a complete or partial luxation, however, is produced, it may happen nearly with equal ease on either side ; but the bones will be more readily forced backward than forward, owing to the flexor muscles and tendons of the leg being much stronger than the extensors.

The most partial luxation of this joint is readily distinguished, not only by the violent pain which it excites, and the lameness with which it is attended, but by the deformity which it produces, and which is always obvious on comparing both knee joints together.

When the patella is dislocated at the same time with the tibia and fibula, it will, for the most part, be reduced along with these bones; but when this does not happen, it may be afterwards replaced in the manner I have mentioned in the last section.

Luxations of this joint are to be reduced by fixing the thigh with sufficient firmness, and extending the leg till the ends of the bones are entirely clear of each other; when the tibia and fibula will be easily replaced. In partial luxations, the degree of extension necessary for this will be inconsiderable; but where the bones are completely displaced, more force will be required. It is scarcely necessary to observe, that the muscles of the leg should be as much relaxed as possible while the force for extending it is applying.

Scarcely any joint is so apt to suffer from inflammation as that of the knee; so that in all such injuries as this, where the surrounding soft parts are so liable to inflame and become painful, the most strict antiphlogistic course becomes requisite; local blood-letting should be prescribed, and repeated according to the violence of the symptoms and strength of the patient; and the limb should for a considerable time be kept at perfect rest.

The upper as well as the under end of the fibula is sometimes forcibly separated from the tibia. As the symptoms which this excites are similar to those which occur from sprains of the muscles, the nature of the injury is often overlooked. It may almost always, however, be distinguished by attentive manual examination. The only method of obtaining relief is by replacing the bone, which for the most part is easily done, and retaining it with a proper bandage till the parts have recovered their tone.

SECTION XVI.

Of Luxations of the Foot at the Joint of the Ankle.

THE joint of the ankle is formed by the upper part of the astragalus or first bone of the foot, being received into a cavity in the under end of the tibia; which is bounded externally by the end of the fibula projecting a considerable way past the end of the tibia.

The astragalus may be dislocated either backward or forward, outward or inward, but it is more frequently pushed inward than in any other direction. The great strength of the tendo achillis prevents it from slipping easily backward, and it has also some effect in preventing it from going forward. It cannot be pushed outward without breaking the projecting end of the fibula.

Dislocations of this joint are in general easily discovered by the pain and lameness which they produce, as well as by the obvious alteration which they occasion in the appearance of the foot. When the astragalus is pushed forward, the foot appears to be lengthened and the heel shortened; when pushed backward, the foot is shortened and the heel lengthened; and when luxated, either outwardly or inwardly, there is always a preternatural vacancy on one side of the joint, and a prominency on the other.

In the reduction of this luxation, the patient should be placed either upon a table or on a bed, and the leg, with the knee bent, should be firmly secured by an assistant or two. The foot is now to be put into that situation which tends most effectually to relax all the muscles that belong to it; and being given to an assistant, he must be desired to extend it in that direction till the most prominent point of the astragalus has clearly passed the end of the tibia, when the bone will either slip into its place, or may be easily forced into it.

As the upper part of the astragalus is not perfectly round, but rather somewhat hollow, this joint is more apt to be partially luxated than any other formed by a ball and socket, as this in some measure is : partial luxations of it, however, are easily reduced.

Besides the antiphlogistic course that I have advised after all luxations of the large joints, it is particularly necessary in luxations of the ankle to keep the limb for a considerable time at the most perfect rest, especially where the under extremity of the fibula is broken, by the foot being forced outward ; for, as the stability of the joint depends in a great measure on this bone, if it be not either rightly replaced or retained in its situation, till the cure of the fracture is effected, it may afterwards continue weak during life, or be attended with stiffness and a great degree of pain. The weakness that succeeds to this kind of injury, if it be not removed by these measures, will be most effectually obviated by a firm splint of thin iron connected with the shoe, and applied along the outside of the leg ; or by an instrument invented by the late Mr. Gooch, represented in Plate XCIV. fig. 4.

SECTION XVII.

Of Luxations of the Os Calcis and other Bones of the Foot.

THE os calcis, which is the largest bone of the foot, is sometimes dislocated laterally, where it is connected with the astragalus. It is prevented from being pushed forward by the other bones of the foot ; and the tendo achillis, which is inserted into a large rough process of this bone which projects backward and forms the heel, prevents it from being luxated in this direction.

The astragalus and os calcis are sometimes luxated at their junction with the os naviculare and os cuboi-

des ; and as this joint, if it may be so termed, is at no great distance from the ankle, this variety of luxation has, in some instances, been mistaken for luxation of the ankle. The foot may at this part be pushed either outward or inward, or be forced directly downward : it will rarely be luxated upward, as it can scarcely be exposed to external violence in such a direction as could have this effect.

Luxations of any of these bones are readily discovered by the pain and lameness with which they are always attended ; as well as by the alteration which they produce on the shape of the foot.

The *os calcis*, when completely displaced, is more difficult to reduce than almost any other bone of the foot : it can only be done by fixing the leg and foot in such a position as tends most effectually to relax the different muscles that belong to them ; and while they are in this position, by endeavouring to force the bone into its situation ; and this will be more readily done, if during the operation the foot is extended.

In luxations of the *astragalus* and *os calcis* with the *os naviculare* and *os cuboides*, as the anterior part of the foot is apt to be drawn towards the heel, it becomes necessary to extend it to such a degree as may clear the bones on the opposite sides of the joint of each other ; for till this is done, the reduction cannot take place, while the bones will immediately slip into their situation as soon as they are drawn past each other.

The other three bones of the *tarsus*, usually termed the cuneiform bones, as well as the metatarsal bones, and the bones of the toes, are all liable to be luxated, and they may be displaced almost in every direction. But it is not necessary to speak of the method of reducing them ; for the observations that I had occasion to make on dislocations of the bones of the hand are equally applicable here : so that I shall now refer to what was said on that subject in the twelfth Section of this Chapter.

CHAPTER XLI.

OF DISTORTED LIMBS.

LIMBS may be distorted in various ways, and by different causes ; either from a morbid state of the bones, or from a contracted state of the muscles, or the bones and muscles may both be affected. In some cases, distortions are owing to original malconformation ; in others, they arise in infancy, and in some, at more advanced periods of life.

For a considerable time after birth, the bones are soft and pliable, and are easily affected by the postures of the body. The bones of the legs are apt to be crooked by children being made to walk too early. This also is the effect of some diseases, particularly of rickets, which soften the bones so much that they easily yield to the posture of the body, as well as to the ordinary action of the muscles. But the most frequent cause of distorted limbs is that contraction of the flexor muscles of the leg and fore-arm, which is often induced by an inflamed state of the knee and elbow, and of which we have a very common example in those cases of white swelling to which these joints are more particularly liable. As the limb lies in greatest ease while the muscles are relaxed, the patient naturally keeps it always bent ; and when this posture is long continued, it almost constantly terminates in such a contracted state of the flexor tendons, as keeps the under part of the limb at an angle with the superior part of it : of this we meet with daily instances in the leg ; where from this cause alone a patient is often altogether deprived of the use of his limb.

As it has been a prevailing opinion among practitioners, that little advantage is to be derived from any remedies that we can employ for distorted limbs, they have seldom made any attempt to cure them : in con-

sequence of which, this branch of practice has been almost universally trusted to itinerants or to professed bone-setters. In this, however, we are wrong; and in saying so, I can speak with confidence, founded on much experience: having early in life observed the misery to which patients with distorted limbs were reduced, I was resolved to make some attempts for the relief of such as might apply to me, however small the chance might be of succeeding; and in various instances I have had the satisfaction of relieving, and in some cases of curing completely, patients who had been lame for several years, and where it was not expected that any thing could be done for their advantage. Where an anchylosis is formed by the ends of two bones forming a joint having adhered together, it would be in vain to make any attempt to remove it, unless the inconvenience attending it were uncommonly great: in which case, if it were the patient's desire, this might be a reason for amputating the limb; or in particular instances, it might be removed by taking out the ends of the bones forming the joint, and allowing the newly divided ends of them to unite to one another: but when the stiffness of a joint depends on a contracted state of the muscles and tendons that serve to move it, by much the most frequent cause of distorted limbs, we may almost in every instance afford relief by more simple means; and where a limb is crooked by a bone being bent, whether it may have happened from improper management during childhood, or as the effect of rickets or any other disease, we may very commonly, by timely attention, either remove it entirely, or render it much less considerable.

Where a limb is distorted from a stiff contracted state of the muscles and tendons that belong to it, a free use of emollients, with moderate gradual extension, is the remedy from which I have derived most advantage, and which never in any instance does harm. Those who have not been in the practice of using emollients for this purpose, may imagine, that they

will not penetrate to the depth of the muscles and tendons ; and when I first employed them, I must own, that I did not expect they were to do so in any remarkable degree : but, knowing no other remedy that was likely to lubricate so effectually parts that were become stiff, I was resolved to give them a complete trial ; and I was soon convinced of their utility : when the Treatise on Ulcers was first published, I had occasion to mention this, and since that period very ample opportunities have occurred of employing the same remedy with advantage.

In order, however, to gain this end, emollients must be used with great freedom. All the contracted muscles and tendons, from their origin to their insertion, must be well rubbed for at least half an hour three times a day ; and the limb should be kept constantly moist with, or as it were immersed in, the emollient, by being covered with flannel well soaked in it at every repetition of the frictions. While the frictions are applying, the limb should be slowly, though firmly, extended to as great a degree as the patient can easily bear ; and the instrument represented in Plate XC. may be afterwards applied, in order to prevent the muscles from contracting.

It is necessary, however, to remark, that this extension should not be made quickly : by doing so, much harm has been done, inasmuch that joints have become pained and inflamed, where there was not previously any other disease than stiffness of the flexor muscles ; while it may be done with the utmost safety in the gradual manner I have mentioned. In the one way, indeed, several months may be required for effecting what a greater force might accomplish in as many weeks ; but the latter must always be attended with pain and hazard, while with the other we proceed with ease and safety.

Even where extension is not necessary, the effects of emollients are often conspicuous. We frequently meet with stiff joints, particularly in the ankle, without any

contraction or distortion of the limb. In this case, emollients alone, if duly continued, will commonly relax them sufficiently.

Every kind of greasy application proves useful here, but animal fats answer better than vegetable oils. The grease of geese and ducks and other fowls answers well ; also hogs lard, and the oil obtained from boiling recent bones of beef and mutton in water. Butchers usually keep this oil in quantities : when properly prepared, it is quite pure and transparent, and has no smell.

When the distortion of a limb proceeds from a bone being bent, if this is not of long duration, and especially when it occurs in childhood, we may frequently remove or lessen it by constant pressure gradually increased on the convex side of the limb, till the bone is brought into its natural direction.

This kind of deformity often occurs in patients labouring under rickets ; but we find it most frequent in new born children, either from original malconformation, or from some singularity in the situation of the child while in the womb. It is most frequent in the legs, when it also affects the direction of the feet and ankles. When the bones of the leg are bent outward, the foot is turned inward ; and, vice versâ, the foot is turned outward when the leg is bent inward. Patients affected in this last manner are called *valgi* ; and *vari* when the feet are turned inward.

These distortions of the feet and ankles, have been supposed to originate in almost every instance from malconformation in the bones forming the joint of the ankle ; and the means that have been proposed for removing them, have been meant to produce an alteration of that joint : they may in some cases arise from this cause, but I have scarcely met with it. At first view of the disease, we are indeed apt to imagine that the fault lies chiefly in the ankle ; but it will be very universally found, as I have just observed, to proceed from the form of the leg. When the leg is bent

outward, the toes are turned inward, and the side of the foot downward; or, if the curvature of the leg is considerable, the sole of the foot will be turned nearly altogether upward, while the top of the foot will rest on the ground on every attempt to walk: and, on the contrary, when the bones of the leg are bent inward, the toes and sole of the foot will be turned outward and upward.

Whoever will examine with attention the effect produced upon the foot by the bones of the leg being curved in the manner I have described, will find, that the maladies we are now considering must necessarily result from it; and although it may occasionally happen, that the joint of the ankle is affected by a long continuance of the distortion, yet in almost every instance, the disease will be found to proceed originally from the cause I have mentioned: so that in the cure, our views should be chiefly directed to this affection of the leg. By removing the curvature of the bones, the foot will gradually regain its natural situation, while all our endeavours will fail, if we only attempt to alter the direction of the ankle joint.

When the foot and toes are turned inward, solely from a malconformation of the ankle joint, we ought no doubt to endeavour to give the joint a better direction; but as I never met with an instance of this, I must leave the particular mode of effecting it to those who may happen to see it. The best method of applying pressure to the bones of the leg when bent, is by fixing a firm splint of iron in the shoe, on the concave side of the leg; and if the head of the splint be made to rest against the corresponding condyle of the femur, and the other end of it on the foot, an easy gradual pressure may be made upon the opposite side of the leg, by one or two broad straps passed round both the leg and the splint. If the splint is covered with soft leather, and properly fitted to the parts, it gives no uneasiness; and by drawing the strap surrounding it with the leg tighter from time to time,

the pressure is increased in the gradual manner I have mentioned. In Plate XCIV. figs. 1. 2. and 3. an apparatus is represented; which in different cases, where the curvature of the leg was very considerable, and where the sole of the foot was turned almost entirely upwards, answered the purpose completely. It proves sometimes sufficient to fix the small end of the splint in the shoe, and the broad flat pad at the top on the condyle of the femur. A splint for this purpose is represented in fig. 2. This gives it two fixed points, by which we have it in our power to make any necessary pressure with the straps passed round the leg: but in some instances, as was the case in two of those to which I allude, the sole of the foot could not be kept so much down as to admit of this, without fixing the shoe to a frame, as is represented in fig. 3. for in all such cases the sole of the foot should be kept as much as possible in a natural situation, otherwise the pressure made upon the leg for removing the curvature in the bones is apt to give a wrong direction to the joint of the ankle, by the under end of the splint being necessarily made to rest on it.

I have thus given a general view of the nature of this affection, and of the management best adapted for removing it: but whether limbs are distorted from a contracted state of the muscles that belong to them, or from a curvature in the bones, much variety must occur in the application of the remedy, particularly in the manner of applying the extension. The treatment, indeed, that suits one case best, is seldom exactly applicable to another: it must therefore be varied according to the judgment of the practitioner.

Other means have been proposed for removing curvatures in bones: of these the best I have seen is an invention of a late ingenious artist of this place, Mr. Gavin Wilson, who was long much employed in this branch of business. In Plate XCIII. fig. 1. and 2. I have represented one of Mr. Wilson's instruments for distortions of the leg.

CHAPTER XLII.

OF DISTORTIONS OF THE SPINE.

THE spine may be distorted in various directions ; outwardly, inwardly, and laterally ; and in some cases it happens in all of these directions in the same person. This sometimes arises from external violence ; but more frequently as a symptom of a delicate frame.

Besides the deformity which these distortions produce, they are apt to injure the health, by compressing the abdominal and thoracic viscera, and inducing paralytic affections of the lower extremities, in consequence of the pressure which they produce on the nerves of those parts. They occur in all ages ; but more frequently about puberty than at any other period, and more commonly in girls than in boys. In general, their effects are observed before the cause is suspected ; for there is seldom much pain in the distorted part.

When distortion of the spine occurs during infancy, the patient appears to be suddenly deprived of the use of his limbs ; but at more advanced periods, he complains first of feebleness and languor, and of numbness or want of feeling in the under extremities. By degrees this want of sensibility is found to increase ; and he is often observed to stumble and to drag his legs instead of lifting them cleverly, nor can he stand erect for any length of time but with much difficulty. At last he loses the use of his legs entirely, which become altogether paralytic ; and when the spine is distorted forward, so as to compress the thoracic and abdominal viscera, he becomes distressed with dyspnoea, or with complaints in the stomach and bowels, according to the part of the spine that is diseased.

In some the loss of power in the extremities takes place in the course of a few days from the first ap-

proach of the disease; and it sometimes becomes gradually less, although it never is, so far as I have observed, entirely removed.

On the deformity being discovered, we sometimes find that one of the vertebræ only is displaced: sometimes two or more are affected; and in some cases it appears to arise solely from a thickening of the ligaments connecting the vertebræ together, without any particular affection of the bones. When one of the vertebræ only is displaced, the patient is usually more completely deprived of the power of his limbs than when two or more of them are displaced, owing perhaps to the angle being more acute, and consequently the pressure on the medulla spinalis more considerable when one bone only is thrown out of the range. This also accounts for the paralytic symptoms being in some instances less remarkable in more advanced stages of the disease than they were at first; for although one bone only may be displaced at first, yet one or both of the contiguous vertebræ almost constantly yield at last; and the difference arising from this is so great, that patients almost always linger and die in the course of a year or two, often in less time, when one bone only is deranged; while they live for a great length of time, frequently as long as if no such circumstance had occurred, when the curvature of the spine becomes more extensive.

As distortions of the spine often proceed from delicate weakly patients indulging too much in particular postures, every habit of this kind should be avoided on the first appearance of the disease. If the patient has been accustomed to lean much to one side, the reverse of this should be advised; and that the body may lie as much as possible upon an equal surface during sleep, he ought to use a hair mattress laid upon boards instead of a bed of feathers or down.

By attention to these points; by the use of an invigorating diet; the cold bath, bark, and other tonics; the disease has been in some cases prevented from ad-

vancing so far as it otherwise probably would have done : but where any of the bones have been affected, I have never seen an instance of a complete cure being obtained. Mr. Pott, to whose observations upon this subject we are much indebted, speaks highly of the effect of issues placed as near as possible to the tumor. He advises an issue to be opened with caustic on each side of the tumor, large enough to admit a kidney bean, and the bottom of the fore to be sprinkled from time to time with powder of cantharides. This I have practised in various cases, and in some instances with obvious good effects : but in all of these there was reason to suppose that the seat of the disease was in the ligaments only, and not in the bones of the spine. When they have appeared to prove useful where the bones have been affected, I conclude that the mitigation of symptoms has arisen from the cause I have mentioned, the pressure upon the spinal marrow being lessened in the progress of the disease.

Various machines have been invented for the removal of distortions of the spine by pressure : all of these, however, do harm, and ought never to be used. It must at once appear, to whoever is acquainted with the anatomy of these parts, and with the nature of this disease, that the displaced bone is never to be forcibly pushed into its situation ; and if this cannot be done, it is obvious that no advantage is to be derived from the practice, while it is evident that much harm may ensue from it.

In all distortions of the spine, it is an object of the first importance to support the head and shoulders. If this is neglected, the weight of the head tends almost constantly to increase the curvature. The collar usually employed for this purpose answers nearly as well as any other. In Plate CI. fig. 1. a representation is given of one with some improvements, by which both the head and shoulders may be very effectually supported ; and in fig. 3. another is delineated for supporting the shoulders only.

CHAPTER XLIII.

OF NECROSIS.

TILL lately little was understood of this very singular disease: not from its being new, or that it has only lately made its appearance, for it seems to depend on causes that have probably existed equally in all ages; but from its having been confounded with other diseases, from which however it is widely different.

We meet with many detached observations on this disease, in the works of Hildanus, Cheselden, Gooch, Hunter and others, but my friend Mr. Russell was the first who gave a regular systematic account of it: the description indeed that he gives of it is so full, clear, and perspicuous, that scarcely any thing new is left for others to add to it.*

The term necrosis, is derived from the Greek word *nekros*, mortuus; in allusion to one of the most remarkable circumstances of the disease, which consists in the spontaneous death of one bone, and the reproduction of another, the last of which is in part formed before the other can separate.

The old bone, which separates, and commonly comes away either dissolved in the form of matter, or in one or more pieces, is termed the sequestra, and it is always surrounded by and included in the new one, so that the new bone must be larger in circumference, though not longer than the other. This being the case, we would naturally suppose that those tendons of muscles which were originally inserted into that

* Vide a Practical Essay on a certain disease of the bones, termed Necrosis, illustrated with six plates, by James Russell, F. R. S. surgeon, Edinburgh.

portion of the old bone that is now destroyed, would completely lose their influence: but it is quite otherwise; for we find, that they possess their relative situation in the newly formed bone, into which they are inserted by the ossification of a gelatinous fluid poured forth around them. The new bone which is thus produced, appears to be possessed of all the essential properties of the original. It is not indeed so regular in its external appearance, nor internal structure, for it is not lamellated, but it can set out ossific granulations; it may exfoliate, and it performs all the functions peculiar to an original bone.

From all the experiments and observations that have hitherto been made on the subject, it seems to be probable that the periosteum is no way concerned in the production of the new bone; that it does not furnish granulations for its increase; that destruction of the marrow does not naturally follow an attack of necrosis; but that this process never takes place without a previous state of inflammation.

The symptoms attending necrosis are the following: First, there is a deep seated pain in the limb; and inflammation and suppuration take place: the matter thus formed discharges itself in one or more openings in the most prominent parts of the limb, and these openings communicate with sinuses that commonly go to the depth of the bone: the matter for the most part is good, though copious, and it cannot be increased in quantity by pressure.

The sequestra is not always discovered by the probe, and the sore sometimes heals without the former being thrown off; at other times, however, when the inflammation is severe, the sequestra is thrown off quickly, which commonly excites a temporary loss of power of the whole limb: but in general the inflammation is slight; the process of separation goes on slowly; and the patient retains the motion and use of his limb.

In the course of the disease, the sores frequently heal and break out again, and holes form in the newly formed bone corresponding with the sinous openings on the surface: it has been found, that in this disease even joints are regenerated, and in that case the cartilage is always larger than in the original sequestra; this has taken place in the lower jaw, where new sockets are formed for the teeth which have been retained.

The progress of necrosis is always tedious; in some it will be over in the course of a few months; but in a great proportion of cases it goes on for two or three years.

We chiefly meet with necrosis in infancy and early youth, and more frequently in the lower jaw and in the bones of the leg than in any other part of the body.

The most obvious predisposing causes of necrosis are lues venerea, and a scrofulous diathesis; and in some instances we can trace the exciting cause to an external accident, as a blow or a bruise.

The diseases for which necrosis may be mistaken are the following: caries of a bone produced by inflammation or collections of matter without exposure to the external air; and it may be mistaken for the exfoliation of an external lamella of a bone: but in the latter the internal surface is smoother, the matter is thin and fetid, and the granulations less firm and more extensive than in necrosis.

The danger arising from necrosis is in a great measure to be estimated from the degree of inflammation and fever that takes place: it seldom proves dangerous, and where these symptoms are moderate, the patient is able in a great proportion of cases to conduct his ordinary business without confinement; but when he becomes hectic, as sometimes happens, immediate amputation of the limb is perhaps the only remedy to be trusted.

In the cure of necrosis, no general treatment proves of any avail, and there is reason to think, when the sequestra separates easily, that the interference of art should never be advised. If it be not indeed in certain circumstances, it is perhaps our best practice to do nothing in the whole course of the disease but to obviate particular symptoms.

When the pain is severe, local bloodletting and the general effects of antiphlogistic remedies, as I have already observed, are to be chiefly depended on. When matter is formed and is found to lodge in any of the soft parts of the limb, it ought to be discharged by small openings, and the strength of the patient requires to be supported by due attention to a well regulated diet, as otherwise it is apt to sink by the long duration of the disease.

In this manner a cure is frequently obtained without any farther assistance from art, that is, the sequestra either dissolves and comes away insensibly in the matter discharged from the fore; or it comes off in one or more pieces; or the irritation that it excites becomes inconsiderable, and the sores at last heal, while the sequestra still continues surrounded with the newly formed bone. The limb is larger than the other, and commonly somewhat deformed by the inequalities on the surface of the bone; but under these inconveniencies the patient sometimes escapes without much pain, and with little or no injury to his constitution.

It sometimes, however, happens, that the sequestra does not come away, while at the same time it creates so much irritation, that fever takes place, by which, and by a profuse discharge of matter from the sores, the health of the patient is brought into hazard: in this situation, an attempt should either be made to remove the sequestra by a surgical operation, or immediate amputation of the limb should be advised.

If any part of the sequestra appears, it may be right to endeavour to save the limb by taking it away; but

where no part of the old bone is discovered, under all the uncertainty of the exact situation and state in which it may be, together with the risk of increasing, by this operation the state of irritation over the whole limb, it will probably, in the course of further experience, appear to be our best practice, in such circumstances, to advise the limb to be amputated.

The operation for removing the sequestra is done in the following manner: a longitudinal incision is made through all the soft parts covering the diseased bone: in this manner the bone must be laid completely bare, but if the teguments are sound, no part of them should be removed.

If the sequestra is discovered by any holes in the newly formed bone, and if these are very near to one another, an opening sufficiently large for taking it out may be made with a large scalpel or a sharp chisel and mallet; but it shakes the limb less, and gives less pain to the patient, to do it with reiterated applications of the trephine, and afterwards to cut out with a firm scalpel, such small portions of the bone as the saw may have left. In the event of no opening in the new bone being met with, small holes may be drilled in it with the perforator of a trepan. In this manner the state of the sequestra may be discovered, when by the operation that I have already described, with the head of the trepan, an opening may be made in the new bone of a sufficient size for removing the other. This, however, as I have already observed, is an operation necessarily attended with uncertainty and hazard, so that in a great proportion of cases, it will probably be found to be a safer practice to amputate the limb.

After the sequestra is removed, mild dressings should be applied; emollient poultices and an antiphlogistic regimen prove useful, while symptoms of inflammation take place; by which, and a due attention to regimen, the sore will heal easily, when the health is

otherwise good : the cure however proves always tedious, being seldom completed in less than six months, and as the limb should be kept during the whole period at perfect rest, and as much as possible in the same position, the confinement is necessarily of the most distressful nature.

This, together with the uncertainty and hazard of the operation for removing the sequestra when no part of it appears, makes me conclude, as I have observed already, that in all such circumstances it is perhaps our best practice rather to amputate the limb.

CHAPTER XLIV.

OF AMPUTATION.

SECTION I.

General Remarks on the Operation of Amputation.

BY the term amputation, we usually understand the removal of the whole or part of a limb. We speak of the extirpation of a tumor; of the mamma; of a testis: but we say the amputation of a leg and of an arm.

The mutilation, produced by this operation, renders it one of the most dreadful in the practice of surgery; yet as the only means by which life can be saved, it is frequently necessary. It is an operation, however, so repugnant to humanity, so distressful to the unfortunate sufferer, and in some circumstances so fraught with danger, that nothing but a clear conviction of this necessity can warrant our proposing it in any case.

The operation, indeed, is not difficult: every practitioner accustomed to handle instruments may perform it. But to distinguish with precision the cases which require it, from those which might do well under a different treatment, and to determine the particular periods of each when it ought to be performed, are circumstances which require more deliberation than perhaps any other in surgery: I shall therefore enumerate the causes which may render amputation necessary, before proceeding to describe the method of performing it.

SECTION II.

Of the Causes which may render Amputation necessary.

THIS operation may be rendered necessary by various causes ; all of which may be comprehended under the following heads.

1. Bad compound fractures.
2. Extensive lacerated and contused wounds.
3. A portion of a limb being carried off by a cannon ball, or in any other manner, if the bones are unequally broken and not properly covered.
4. Extensive mortification.
5. White swellings of the joints.
6. Large exostoses, whether they are confined to joints, or spread over the whole bone or bones of a limb.
7. Extensive caries, accompanied with bad ulcers of the contiguous soft parts.
8. Cancer, and other ulcers of an inveterate nature.
9. Various kinds of tumors.
10. Particular distortions of a limb.
11. Necrosis.

Each of these causes I shall consider in the order in which they are mentioned.

In Chapter XXXIX. Section XVI. I had occasion to speak particularly of compound fractures : I shall at present therefore only remark, as the substance of what was then fully pointed out, that in the army and navy, where ordinary patients cannot be duly attended, and where they must be much jolted, and often removed from place to place, immediate amputation should be advised in all cases of bad compound fractures. Cases will often indeed occur even in the worst situations, in which it will be improper to amputate the limbs. Thus, where little violence has been done, and where the bones have been broken so much in a

transverse direction, that when replaced they support each other with firmness, and especially if one bone only is broken, it would no doubt be a severe, and often an unnecessary measure, to propose the removal of the limb. But whenever much violence has been done to a limb ; when the bones are broken in such a manner that they do not, even when exactly replaced, support each other firmly, and when the fleshy parts that cover them are much torn ; in all such situations, I consider it as a good general rule to advise immediate amputation. Unless the operation, however, can be performed soon after the accident, it cannot again be admissible for a considerable time ; for whenever a limb has become swelled and inflamed, it can never, but with the utmost danger, be taken off till these symptoms subside.

In private practice, however, where the patient can from the first be placed in an easy comfortable situation, from which he need not be removed till his cure is completed ; where he can be kept perfectly quiet, and have all the advantages of good air, a proper regimen, and the assistance of able practitioners, very few cases will occur in which immediate amputation should be advised. The only cause, as I have elsewhere observed, which in such circumstances can render immediate amputation proper, is the bones of a limb, together with the muscles and other soft parts with which it is covered, being so shattered and bruised that there will be no chance of the limb being rendered useful by any attempt that might be made to save it : in such circumstances, it should be removed immediately ; but this not being done, the operation, as I have observed above, should be delayed, till the swelling, inflammation, and fever induced by the accident, are removed.

Although early amputation, however, is seldom necessary in private practice, yet, in the after treatment of compound fractures, it is sometimes proper :

1. In consequence of profuse hemorrhagies which cannot be otherwise stopped. These sometimes hap-

pen from one or more arteries being cut by the ends of the fractured bones, as well as from other causes.

2. In consequence of extensive mortification. This we shall have occasion to consider more particularly in speaking of mortification as one of the general causes of amputation.

And, 3. By the ends of the fractured bones remaining long disunited, attended with the discharge of such large quantities of matter, that the patient runs some risk of sinking under it.

I have elsewhere observed, that the union of fractured bones is sometimes prevented by a loose portion of bone being left which ought to have been removed; and nothing more readily keeps up a profuse discharge of matter: but when all such pieces of bone have been removed; when no union takes place; or when the discharge still continues in such quantities as to weaken the patient notwithstanding of all that can be done to prevent it; such as preserving the limb steadily in one posture, regular dressing of the sore, a nourishing diet, and a plentiful use of bark; nothing will in such circumstances so certainly save the patient as the removal of his limb.

2. I mentioned extensive laceration and contused wounds as the second general cause of amputation. Wounds not accompanied with fractures of the contiguous bones are seldom so bad as to require amputation in any stage of them: but when a limb is so severely lacerated or contused as to have all the large blood vessels that belong to it destroyed, so as to leave no ground of hope that the circulation can be preserved in it, immediate amputation should be advised, whether the bone is safe or not. As in such circumstances no effort on the part of the practitioner could save the limb; and as wounds of this description are more apt to terminate in mortification than any other, the sooner the operation is performed the better.

It will also happen in lacerated and contused wounds, that amputation may be afterwards necessary, although

it did not appear to be so at first. In this respect they are similar to compound fractures, and the same observations will apply to them. Hemorrhagies may occur which cannot be stopped ; extensive mortification may take place ; and such large quantities of matter may form, that the patient will not be able to bear up under the discharge. In any of these events, we have to consider the removal of the limb as the only remedy.

3. The removal of a portion of a limb by a cannon ball or other violence, was mentioned as the third general cause of amputation.

This is one of those cases which many contend can never require amputation : for the limb being already removed, it will be better, they allege, to endeavour to heal the sore, than to add to the pain and danger of the patient by an operation. The argument is plausible, but it will not bear examination.

In wounds of this kind, the bones are commonly much shattered, and even splintered ; and the muscles and tendons are left of unequal lengths, and much lacerated and contused. In this situation it is allowed by all, that the separate pieces of bone, as well as the sharp ends of the remaining bone, should be removed, together with the ragged extremities of the muscles and tendons. Now all this could seldom, I believe, be done in less time than the operation of amputation ; while by amputating above the injured part, and covering the bone with sound muscles and skin, we diminish the sore so much that it would probably heal in a third part of the time that the original wound would require ; at the same time that the patient will have a good stump, which in the other method never could be the case : with me this last argument of itself would be sufficient for advising the operation under the circumstances we are considering : for, as I do not suppose it would add to the danger, any additional momentary pain it might occasion, would be amply compensated by the advantage he would after-

wards derive from it. When the practitioner has it in his power, the operation should be advised immediately ; for, however necessary it might be, many patients would not afterwards have sufficient firmness of mind to submit to it ; and, from ignorance of the advantages to be derived from it, would prefer present ease, to future conveniency and advantages, however great they might be.

4. Mortification is the next cause we have to consider by which amputation may become necessary. They who are determined to oppose the practice of amputation as much as possible, affect to consider it as unnecessary even in mortification : all the lesser degrees of it, they observe, may be cured ; and when very extensive, the patient, they allege, will commonly fall a sacrifice to the disease, whether the operation is performed or not. This opinion, however, is so directly contrary to fact, and to the experience of every unprejudiced practitioner, that I need not attempt to refute it : for although it would be highly improper to advise the removal of a limb in slight degrees of gangrene ; yet when mortification has spread so extensively as to destroy all or even a great proportion of the soft parts of a limb, an occurrence too frequently met with, what remedy could be employed instead of it ? As I know of none, and as I never heard of any that in any way could prove useful, I shall conclude, that in mortification proceeding to such an extent as I have mentioned, amputation of the limb becomes indispensable.

But although this doctrine will be generally admitted, yet practitioners are not agreed with respect to the period of mortification at which the operation should be performed. Some contend, that in almost every case of gangrene, and especially where it proceeds from external violence, the limb should be amputated as soon as mortification is evidently formed, and while it continues to spread : others are of opinion, that amputation should never be advised till the

gangrene is not only stopped, but till the gangrenous parts are separated from the sound.

Those who advise immediate amputation observe, that by taking the limb off above the diseased part, we may prevent the progress of the mortification, and may thus save the patient. Although the argument is specious, it does not appear to be well founded ; and so far as my observation goes, I would say that it is a practice fraught with danger, and ought universally to be discarded : for however attentive we may be in amputating at a part of the limb that appears to be sound, even the most experienced practitioner will be liable to be deceived. The skin may be perfectly sound, and may be free from pain, inflammation, and swelling ; and yet the deep seated muscles, and other parts contiguous to the bone, may be in a state of gangrene. Of this I have seen various instances : but even where the whole divided parts are found to be entirely sound, if the operation is performed while mortification is advancing, the disease seldom fails of seizing the stump ; at least, I never knew an instance of the contrary, and I have unfortunately been concerned in different cases where this practice was adopted. On conversing with practitioners, who, from peculiarity of situation, have much employment in those accidents which are most apt to terminate in gangrene, I also find that their experience tends to support this opinion : it was also the decided opinion of the late Mr. Sharpe, and Mr. Pott, and of every modern practitioner of observation.* I think it right to mention this, as attempts have of late years been made by some speculative practitioners to introduce a contrary practice ; which if admitted, there is much reason to suspect would prove extremely hurtful, although from its proving so universally

* Mr. Pott's words upon this point are very strong : " I have more than once seen the experiment made of amputating after a gangrene has been begun ; but I never saw it succeed : it has always hurried the patient's destruction." Vide Remarks on Fractures, &c.

unsuccessful, there is reason to hope that it will soon be laid aside, even by those who at present patronize it.

I would not think it necessary, however, to delay the operation so long as is advised by some, and particularly by Mr. Sharpe; who thinks that it should never be performed till the separation of the mortified parts is considerably advanced.* As Mr. Sharpe was a man of much experience, his observation may prove to be well founded; but so far as I have yet seen, I would consider it as sufficient to wait till the mortification is completely stopped, but not much longer; in this manner, we seem to reap all the advantages which the caution that I have advised can give; and the earlier after this that the mortified parts are removed, the more readily we prevent the system from suffering by the absorption of that putrescent matter which a gangrenous mass universally yields.

The opinion that I have given relates to every variety of gangrene. In whatever way it may have arisen, the practice should be the same: for although some stress has been commonly laid upon the circumstance of its proceeding from an internal or external cause, yet no utility is derived from this. The operation should in no instance be advised till the period I have mentioned; and at that time, whatever may have been the cause of the disease, no delay should be admitted.

5. In mentioning white swellings of the joints as a cause of amputation, I must refer to Chapter II. Section III. § 10, for the management of the disease, as well as for a more particular account of those symptoms that more especially indicate the operation. At present I have only to observe, that as long as there is the least reason to hope that by any means the limb may be saved without hazard to the patient, the operation should never be advised. As a farther motive for this, I may remark, in addition to what I have in

* Vide Treatise on the Operations of Surgery, Chapter xxxvii.

various parts of this work done already, that amputation, more frequently succeeds, that is, a greater proportion recover from the operation when it is delayed till the patient is considerably reduced by the disease, than when it is performed in the more early part of it. The cause of this may be nearly the same as what I have given in Chapter XXXIX. Section XVI. when advising late amputation in some circumstances of compound fractures.

6. In Chapter II. Section III. I entered upon the consideration of the various kinds of exostosis; so that at present I have only to remark, that when a diseased portion of bone cannot be taken out in the manner I have formerly advised, and when the tumor is either hurting the patient's health or has become unsupportable from its size or any other circumstance, amputation of the limb, when no particular reason prevents it, should be advised as the only remedy.

7. The next cause that I have mentioned of amputation, is an extensive caries attended with ulcers of the contiguous parts. When speaking of caries, in the seventh Section of Chapter V. I pointed out the different means employed for the cure of the disease, that is, for promoting an exfoliation of the diseased part of the bone. In addition to what I had then occasion to say, it may be observed, that although an extensive caries is in general considered of itself as a sufficient reason for amputating a limb, yet it certainly should be admitted under much restriction. However extensive a caries may be, even although it occupies the whole length of a bone, it may be in many instances removed; and we have many on record of deficiencies produced in this manner being amply supplied by a regeneration of bone: so that where the constitution is sound, and more especially when the patient is young, a carious bone will seldom of itself be a sufficient motive for removing a limb, at least the chance of saving it by removing the diseased bone

should first be given. But when a carious bone is conjoined with deep and extensive ulcers of the corresponding soft parts, which might give much cause to suspect that a cure would not be obtained even although the diseased bone should be taken out, amputation should be preferred; for in this situation, besides the difficulty of healing the sores, the formation of any considerable quantity of bone would be very uncertain, and therefore the risk should not be incurred.

8. The next cause to which we have to advert, by which amputation may become necessary, is cancer, and other ulcers of an inveterate nature.

When speaking of cancer in Chapter V. Section VIII. I endeavoured to show, that no dependence is to be placed either upon internal medicines or outward applications for a cure; and that the removal of the diseased part is alone to be trusted. It must be acknowledged that cancer does not frequently occur in the extremities: but every practitioner must have seen it on different parts of them; and wherever it appears, the removal of the diseased parts with the knife should be advised immediately. They may be often taken away without amputating the limb; but when the disease has attacked the ligaments or bones, and especially when the sore is extensive, nothing but the removal of the limb above the parts diseased ought to be trusted. In such circumstances, I have known attempts made to save the limb, but never with success. Even the removal of the limb will sometimes fail; but I have known it answer where the disease had returned after being removed in the usual way.

Besides cancer, other ulcers may, in particular circumstances, render amputation necessary: where an extensive ulcer, not induced by any general affection of the system, is hurting the health of a patient; and when, instead of yielding to the usual remedies, it becomes more extensive and more inveterate, as it might at last proceed so far as to endanger life, we ought

rather to advise the limb to be taken off. Such ulcers as are usually termed phagadenic, sometimes terminate in this fatal manner : but this termination is most frequent in sinuous ulcers ; such as arise from deep seated abscesses, where the matter has found access between the interstices of the large muscles, and where, notwithstanding all our endeavours, the discharge continues to be so profuse as to endanger the life of the patient.

9. Various kinds of tumors may render amputation necessary.

Encysted tumors seldom lead to this necessity ; but in some instances where they are deep seated, originating perhaps from the periosteum, when they are allowed to remain till they acquire a great bulk, all the contiguous parts come to be so much injured, that nothing but the removal of the limb will answer any good purpose. In some cases, by long continued pressure from the tumor, the contiguous bones not only become carious, but are altogether dissolved ; at the same time that the cellular substance, and even the muscles of the limb, become so much diseased as to give no cause to hope that we could be able to save them.

We sometimes find a portion of a limb considerably enlarged, with an uniform hardness in some parts, and in others a degree of softness that gives cause to suspect that a fluid is collected beneath. The skin at first retains its natural colour ; but at last acquires a livid hue. The commencement of the disease is not attended with pain ; but at last it not only becomes painful, but extremely troublesome from its weight. It usually begins without any evident cause, and often in people who are otherwise healthy : at first the swelling commonly appears on the inferior part of a limb, and proceeds gradually up till it occupies the whole of it.

This kind of swelling is at first often mistaken for common œdema or anasarca ; and seems to be so far of this nature, that it is evidently produced by effusion into the cellular substance : but instead of being of the serous kind, the effused fluid is found to be tinged with blood, and of an acrimonious nature ; at least this has been the case in all that I have known opened : and it has likewise happened, that the matter has never been discharged in such quantities as to have much influence on the size of the tumor, the swelling usually remaining of nearly the same bulk after the operation as it was before : hence no advantage is derived from it ; on the contrary, the operation very commonly does harm. A painful fore is produced ; and it always accelerates the progress of the tumor. Indeed, nothing that I have ever known employed has any effect in retarding it ; so that I consider amputation as the only resource, whenever the tumor has become so large as to give much uneasiness. Whether it will always prove effectual or not, I cannot pretend to say ; but hitherto I have met with no instance of the disease returning where amputation was performed on a sound part of the limb.

Swellings of the aneurismal kind have also been considered as a cause which, in particular situations, may give rise to amputation. This has originated from the operation for the aneurism having failed in different instances when performed upon the crural artery, and from the amputation of the limb having in similar affections saved the life of the patient. When an aneurism in the ham or the thigh is large, and has been of such long duration as to hurt the texture of the soft parts, as well as to injure the bone, which effused blood is apt to do, it will no doubt be better to amputate the limb than to make any attempt to save it : but in such a case, it is not the aneurism for which amputation is advised, but a morbid state of the parts, induced by the disease being allowed to continue too long before any effectual measure is adopted. In the

commencement, and for a considerable time thereafter, of the femoral or poplitean aneurism, I should never advise the amputation of a limb : for different instances are on record of limbs being saved by the operation for the aneurism, even where the artery was injured in the superior part of the thigh : but where such an extensive œdematous swelling is induced all over the under part of a limb, as to leave no room to hope that it could again be restored to use, even allowing the operation for the aneurism to succeed, it will no doubt be better to amputate immediately than to attempt the operation.

The aneurism to which I allude, is that which proceeds from a dilatation of the artery, and in which the coats of the vessel have burst, so as to produce a considerable effusion of blood into the surrounding cellular substance, probably before any proper assistance is desired. This will seldom happen but with the poorest class of people ; and therefore this disease, in the state we are now speaking of, is chiefly found in hospitals. At first it is always attended with a strong pulsation ; but in its latter stages the swelling becomes so large, that the beating of the artery is scarcely, if at all discovered ; by which it is apt to be mistaken for a tumor of a different kind : but for the most part, a due attention to the history of the case from the beginning, will lead to a knowledge of its real nature.

The 10th general cause that I enumerated, by which amputation may become necessary, is particular distortions of a limb.

Where a limb is in other respects perfectly sound, it will seldom happen that any distortion to which it is liable will be considered as a sufficient reason for this operation : but in the course of much business, cases are sometimes met with in which limbs are so much distorted, and produce so much distress, that patients rather incline to have them removed than submit longer to the inconvenience. When in such circumstances we are not able to remove the distor-

tion by means of a more gentle nature, we are in some cases obliged to comply with the patient's request.

11. Certain states of necrosis may render amputation necessary, as may be seen in Chapter XLIII.

These are the several causes by which the amputation of a limb may be rendered necessary. As they are very various, and as the loss of a member is to every patient an object of much importance, they merit, in every instance, the utmost attention from practitioners. Indeed this point of practice, namely, that of fixing with precision those cases in which the amputation of limbs should be advised, with the most suitable periods for the operation in each, is attended with such difficulty, and a surgeon is so apt to be blamed if he proceeds to the operation so long as there is the smallest doubt of its being necessary, that it should be held as a fixed regulation with every practitioner, never to operate but with the advice of some of his brethren in consultation, when this can possibly be obtained. I shall now proceed to describe the method of operating.

SECTION III.

General Remarks on the Method of Amputating Limbs.

SURGERY is not perhaps in any part of it brought to greater perfection than in the method of amputating limbs. Before the invention of the tourniquet, this operation was attended with so much hazard, that few surgeons ventured to perform it: nay, long after the introduction of this instrument, the danger attending it was so great, that more than one half perished of all who had resolution to submit to it.

In the present improved state of the operation, I do not imagine that one death will happen in twenty cases; even including the general run of hospital prac-

tice : and in private practice, where due attention can be more certainly bestowed upon the various circumstances of the operation, the proportion of deaths will be much less.

The circumstances in this operation that more particularly require attention, are, the choice, when this is in our power, of the part at which a limb should be amputated ; the prevention of hemorrhagy during the operation ; the division of the skin, muscles, and bones, in such a manner as to admit of the stump being completely covered ; the tying of the arteries alone, without including the nerve or any of the contiguous parts : securing the teguments in a proper situation, so as to prevent their retraction after the operation ; and a proper subsequent treatment of the case.

Next to securing the patient from loss of blood, the most material of these is the saving of such a proportion of the soft parts as will cover the stump, so as to heal the fore as nearly as possible by the first intention : for without this, the wound produced by the removal of a large limb is always extensive ; the cure accordingly proves tedious ; and the discharge so copious, that the patient's health is by this cause alone irreparably injured.

The inconveniencies arising from this were so obvious, that various attempts were made, from time to time, to improve this part of the operation. At first, all that was done in amputating a limb, was to cut the soft parts down to the bone by one stroke of a knife, and afterwards dividing the bone with the saw at the edge of the retracted muscles. It was afterwards proposed by Mr. Cheselden to divide the soft parts by a double incision ; to divide the skin and cellular substance with a circular incision ; and then to cut through the muscles at the edge of the retracted skin : by this means the saw was applied higher in the bone, and the stump was better covered both with muscles

and skin. Still, however, an extensive sore was left ; infomuch that in amputating the thigh, a cure was seldom performed in less than three or four months ; often five or six were required ; and after all, the stumps were commonly pyramidal, by the bone projecting beyond the soft parts : it often happened too, that another sore was produced by this part of the bone exfoliating, long after the patient considered himself as perfectly well.

To prevent this pyramidal or sugar loaf stump, as it is termed, a bandage or circular roller was employed, with a view to support the muscles and teguments, and to prevent their retraction ; and when properly applied from the upper part of the limb downwards, it in some degree answered the purpose, but never with such effect as to prevent the cure from being tedious. In order to shorten it farther, it was proposed by the late Mr. Sharpe, in his Treatise on this Operation, to draw the teguments near together by stitches or pieces of tape passed through them, and tied across the stump : but the pain and inconvenience arising from this was so great, that it never was generally practised ; and Mr. Sharpe himself at last desisted from it.

It was now thought impossible to improve this method of operating, so as to shorten the cure, and in place of a pyramidal stump, to give the sore a plain surface. In consequence of this, about forty years ago, different surgeons attempted to revive what was termed the flap operation ; which had been first practised, upwards of a hundred years ago, by an English surgeon of the name of Loudham. It was done by saving a flap of the muscles and skin, in the manner I shall afterwards describe, laying the flap over the stump, and securing it in this situation with proper bandages till it united to the parts beneath.

As this afforded a thick muscular cushion to the stump as well as a complete covering of sound skin, the highest expectations were formed of it : but the

objections to it, which I shall afterwards mention, were so great, that the utmost exertions, even of expert surgeons, to render it more perfect, have not been able to introduce it to general use.

This failure again excited the attention of practitioners to the improvement of the common operation of amputation; and their endeavours have not proved unsuccessful. By the present improved method of operating, so much of the teguments are saved as completely covers the stump; by which, in some instances, a cure is obtained by the first intention without the formation of matter: and in all, unless there is something particularly bad in the habit of body, or unless the inflammation unexpectedly runs to a very unusual height, a cure is completed in the course of a few weeks. As I consider the improvement by which these ends are effected as one of the most important in modern practice, I hope to be excused, if I shortly state the share I have had in the introduction of it, before proceeding to describe the operation itself.

In the course of my education, while attending the hospital here, as well as the hospitals of London and Paris, the inconveniencies arising from the want of attention to the saving of skin in different surgical operations, struck me strongly; so that I was resolved to take every proper opportunity in my own practice, of treating this point with particular attention.

From the year 1772, when I settled in business, I laid it down as a maxim, not to be deviated from, to save as much skin and cellular substance in the removal of tumors, whether cancers or others, when the soundness of part admitted of it, as would completely cover the fores; and in amputating any of the extremities to save as much of them as would entirely cover the stumps. I first performed amputation in the course of that year; and finding the improvement of saving skin to answer even beyond my expectation, (for the cure of a large stump in an amputation of the thigh

was completed in three weeks,) I did not fail of putting it afterwards in practice both in public and private. The practice was likewise adopted by my friend Mr. Hay of this place, and more lately by some other gentlemen in their attendance at the hospital ; and ever since that period, Mr. Hay, I believe, and I, have invariably adhered to it, some deviations being occasionally introduced in the mode of doing it, with a view of rendering it more perfect ; by which the cures have in every instance been greatly shortened. In various cases, large stumps which by the usual method would have required several months, were cured in as many weeks : in a few, as was observed above, the parts united by the first intention ; and in all, a plain uniform stump was produced.

After this had been practised for several years, Mr. Alanfon of Liverpool, in the year 1779, published some Observations upon Amputation, in which a method of operating is described, which he recommends in the warmest manner, as answering every object to be expected from this operation ; and more especially, that of curing the stumps in a great measure by the first intention.

As Mr. Alanfon's mode of operating has of late been very deservedly preferred to every other that was before published, I shall afterwards give an account of it ; but in the mean time, I shall describe that which I have long been accustomed to practise, and which, after various trials of every other of which I have yet heard, I still continue to prefer. In the first place, I shall describe the operation as it is performed upon the thigh, and shall afterwards speak of the method of amputating other parts of the extremities.

SECTION IV.

Of Amputating the Thigh.

IN amputating either the thigh or leg, the patient should be placed upon a table of an ordinary height, with the leg properly secured and supported by an assistant sitting before him. The other leg should likewise be supported, at the same time that the arms should be secured by an assistant on each side, to prevent interruptions during the operation.

The flow of blood to the limb should now be stopped by the application of the tourniquet, in the manner I have mentioned in Chapter VII. and as it is of importance to have the instrument placed as near as possible to the top of the thigh, the cushion placed upon the femoral artery should reach the groin.

This is necessary when the operation is to be performed on the upper part of the limb; but it may likewise be done with safety where it is to be taken off immediately above the knee: and I may here observe, with respect to the most proper place at which a thigh should be amputated, that no more of it should be taken away than is rendered necessary, by the disease; for the more of it that is left, the more useful it proves.

An assistant should now be directed to grasp the upper part of the limb with both hands, and to draw up the skin and cellular substance as far as possible. While the parts are in this state of tension, the operator, standing on the outside of the patient, should divide them with a circular incision down to the muscles: this may in general be done with one stroke of the amputating knife, fig. 3. Plate XCVIII. but in large limbs it is easier done at twice. The assistant continuing to draw the teguments upwards, the cellular substance connecting them to the muscles beneath, should be divid-

ed with the edge of the knife till as much of the skin is separated as the operator thinks will completely cover the stump.

The skin being still drawn tightly upwards, the muscles should be divided close to the edge of it down to the bone, by one perpendicular and continued stroke of the knife, beginning with the upper part of the large muscles on the inside of the thigh, and continuing the incision round through those beneath, and on the outside till it terminates where it commenced. During this part of the operation, some attention is necessary to avoid the edge of the retracted skin ; but it may always be done if the operator is upon his guard, for he may with little difficulty have his eye upon the course of the knife from first to last ; nor can this part of the operation be done with safety in any other manner. Even where different assistants are employed to protect the skin, it will be apt to be wounded, if the operator does not at every point follow the knife with his eye.

In the usual method of operating, the bone would now be sawn across at the edge of the retracted muscles : but we are more certain of having a good stump, if the muscles are previously separated from the bone for the space of an inch ; and it is easily done by inserting the point of the amputating knife between them, and carrying it freely round from one side of the limb to the other. This being done, the muscles and teguments must be drawn up as far as the muscles have been separated from the bone ; and it is easily done, either with a bit of slit leather, such as is represented in Plate XCVII. fig. 4. or with the iron retractors in the same Plate, fig. 2. and 3. The periosteum should now be divided at the place where the saw is to be applied, and it should be done with one turn of the knife ; for where much of it is scraped off, very tedious and troublesome exfoliations are apt to ensue : the knife should therefore be carried round the bone directly beneath the retractors. At this place the saw

should be applied, and with long steady strokes the bone should be divided. The saw represented in Plate XCVIII. fig. 1. answers much better than the usual form of the instrument with a heavy iron back. In performing this part of the operation, the assistant holding the leg should be directed to support it steadily; for if raised too far, the motion of the saw will be impeded, while the bone will be apt to be splintered if it be not sufficiently raised. Any points or splinters that may be left, should be immediately removed with the nippers, Plate XLIII. fig. 2.

The retractors should now be taken off; and the trunk of the femoral artery being easily seen, should be drawn out with a tenaculum, and a sufficient ligature made upon it before the tourniquet is loosened: but as the muscular branches of this artery cannot be discovered as long as they are compressed, the screw should be immediately untwisted, so that the pressure may be entirely removed. All the clotted blood should be now removed from the stump with a soft sponge soaked in warm water; and every artery that can be discovered should be secured with a ligature, care being taken to leave the ends of the threads of a sufficient length to hang over the lips of the wound.

The blood vessels being all secured, and the surface of the wound cleared of blood, the muscles and teguments should be drawn down till the skin completely covers the stump, and should be retained in this situation by an assistant till a flannel or cotton roller, previously fixed round the body to prevent it from slipping down, is applied in such a manner as to support and fix them: for which purpose the roller should be passed two or three times, nearly in a circular direction, round the top of the thigh; and should afterwards, with spiral turns, be brought down near to the end of the stump, of such a tightness as to prevent the muscles and skin from retracting, without compressing them so much as to prove painful, or to impede the circulation. Here the roller should be fixed with a

common pin, while as much of it is left as will pass two or three times round the stump, for a purpose to be presently mentioned.

The ends of the divided muscles being placed with as much equality as possible over the bone, the edges of the skin must be laid exactly together, so as to form a straight longitudinal line along the centre of the stump. When only one or two arteries have been secured, the ligatures should be left out at the inferior angle of the wound ; but when there are several, they should be divided between the two angles, to prevent the parts from suffering by a large extraneous body fixed at any one place.

While an assistant retains the edges of the divided skin in contact, two or three slips of adhesive plaster should be laid across the face of the stump, to preserve them in this situation ; and the whole surface of the stump should now be covered with a large pledget of soft lint, spread with saturnine cerate, or the common calamine cerate of the Dispensatories : over this there should be placed a soft cushion of fine tow with a compress of old linen. For the purpose of retaining them, as well as with the view of making gentle pressure upon the stump, a slip of linen, of three inches in breadth, should be laid over them ; so as to pass directly across, and not from above downwards. On being properly placed, the remaining part of the roller should be employed to fix it, by passing it two or three times round the stump ; and the pressure formed by the cross strap may afterwards be increased or diminished, by drawing it with more or less tightness, and fixing it with pins to the circular roller.

In applying the roller, the tourniquet should be removed, and replaced immediately when the stump is dressed. If left loose, it gives no uneasiness ; and it enables the attendants to check any hemorrhagy that may take place ; a circumstance that merits attention for several days after amputation of any of the extremities.

The patient should now be carried to bed ; but instead of raising the stump to a considerable height with pillows, as is usually done, it should be laid somewhat lower than the rest of the body : for this purpose, the bed should be previously made with a gentle declivity from above downwards, and nothing should be put beneath the stump but fine tow.

To prevent the patient from moving the limb inadvertently, as well as to guard in some measure against the effect of those spasms which often prove troublesome after this operation, I commonly employ two slips of flannel to fix the stump down to the bed. It is easily done, by laying one across near the extremity of the stump, and another near to the root of the thigh. They should be pinned to the circular roller round the limb ; and the ends of each of them should be pinned to the bed : or they may be tied to it with pieces of small tape previously sewed to the bed, or to the mattress, which answers better than a feather bed for any patient to be long confined. A basket or hooped frame should now be put over the stump, to protect it from the bedclothes ; and whether the patient complains much or not, I make it a constant rule to give him an anodyne, by which he remains quiet and easy through the remainder of the day, instead of being restless and distressed, which he is otherwise apt to be.

As hemorrhagies will sometimes happen, even many hours after the operation, the attendant taking charge of the patient should be strictly enjoined to examine the stump frequently with the utmost care ; and on any quantity of blood breaking out, to twist the tourniquet sufficiently tight, till assistance is procured. I think it right, however, to observe, that in general it is the fault of the practitioner when this very perplexing occurrence takes place ; for it seldom happens when the arteries are searched for in the time of the operation with that accuracy which the importance of the situation requires. Indeed, hemorrhagies are less frequent after this method of operating, than when the

muscles are left uncovered ; and this is one material advantage that results from it : for however attentive a surgeon may be in securing the arteries, the irritation produced upon an extensive wound, and the spasms that ensue, very frequently terminate in fatal hemorrhagies. Of this I have known several instances ; while no discharge of any importance has ever happened in the method of operating, of which I have thus given a description. I believe too, as I have elsewhere remarked, that some additional security is derived from the use of the tenaculum : for although those who have not been in the habit of using it, are apt to consider it as more uncertain than the needle, yet it is far from being so. I will not say that hemorrhagies will never ensue where the tenaculum is employed ; but it has so happened in the course of my observation, that the needle was used in every case of hemorrhagy that proved fatal.

Where there is only a trivial oozing of blood, we need not be alarmed ; nor will it be necessary to remove the dressings : but whenever the discharge is so considerable as to give cause to suspect that it proceeds from a large artery, nothing but securing it with a ligature can be depended on. This being done the dressings must be renewed in the same manner as at first.

The only other symptoms that we have reason to dread, during the first three or four days after the operation, are severe spasmodic affections of the muscles, and inflammation and tension of the stump, with the consequent fever which in some degree succeeds to every case of amputation, but which always proves hazardous when it proceeds to a great height.

When the arteries are tied without including the nerves or any part of the contiguous muscles, these spasms seldom become troublesome : but when they take place, if laying the limb in an easy relaxed state does not render them moderate, we trust chiefly to opiates for their removal.

With a view to prevent inflammation, the patient should be confined to as low a regimen as the state of his strength will permit. In weak emaciated habits, this must be managed with much discretion, as the constitution might be materially hurt by a low diet: but where there is much plethora, with tense fibres, together with a strict antiphlogistic regimen, the patient should be bled as soon as quickness and fullness of pulse or other symptoms of fever take place: he should take plentifully of diluent drink; and his bowels should be kept open with any of the cooling neutral salts.

It is proper, however, to observe, that it is only during the first days after the operation that remedies of this kind are in general necessary. When the inflammatory stage is over, evacuations of every kind are to be dreaded; even laxatives are apt to do harm if carried farther than is just necessary for preserving a regular state of the bowels.

At the end of the second day, whatever the previous symptoms may have been, the stump should be examined. Where a free suppuration is expected, as always happens when the stump is not covered with skin, the parts should not be looked at till the third or fourth day: but here there is no reason for this delay; and the patient is always made more easy and comfortable by the removal of the first dressings. For this purpose, the stump should be gently supported by an assistant, till the last turns of the roller are undone, and till the cross slips, tow, and even the large pledget of ointment next the fore, are removed. In a few cases the parts are found united by the first intention; but for the most part it is otherwise: there is commonly a small quantity of matter over the surface of the stump, chiefly at the inferior angle of the wound; and the parts are red, tense, and painful to the touch, with a small separation or opening between the edges of the divided skin, notwithstanding the plasters em-

ployed to retain them. As in this state the plasters do no service, they should likewise be removed; and it is easily done when they are thus moistened with matter. The surface of the stump should now be covered with a pledget of the same ointment as at first; and a cushion of soft tow being laid over it, the cross slips of linen and the circular roller should be again employed; but with no more pressure than is merely necessary for supporting them.

In this manner the dressings should be renewed daily; when, by the seventh or eighth day, the inflammation and tension will in general be so far diminished as to admit of the ligatures on the arteries being easily removed; at least they may now be gently pulled daily, and for the most part they yield on the second or third trial: when allowed to remain longer, they not only prevent the wound from healing, but are apt to be more difficult to remove afterwards.

As long as the roller is preserved clean, it may be allowed to remain; but as soon as it becomes sullied with matter, it should be removed and another applied in its place; nor should it be entirely laid aside till the third or fourth week from the operation. After this period, however, it should be removed, as when longer continued it renders the limb smaller than the other.

As soon as the fore is observed to be perfectly clean, with granulations sprouting in different parts of it, as the pain and tension will now be quite removed, we may with safety venture to complete the cure, by drawing the edges of the wound together with adhesive plasters. In this state of the fore no harm ever ensues from it, and it shortens the cure considerably.

By this management, even the largest stumps will for the most part be healed in three or four weeks; often in less. But it must be remarked, that although we may in general depend on this in private practice, where every circumstance that can conduce to the welfare of the patient will meet with attention, and

where especially we may always obtain a well ventilated apartment and proper diet ; yet in public hospitals, where these points are not duly attended to, and where the patient often suffers more from the bad air that he breathes, than from the operation itself, our success will not in every case be so great. Instead of the teguments adhering to the parts beneath, large quantities of matter sometimes form between them, which always renders the cure more tedious, and which in some cases cannot be accomplished but by sending the patient to a more free air, and by a more plentiful allowance of wine and other cordials than can in general be obtained in hospitals. But for one instance of this, in the operation that I have described, I may with safety affirm, that twenty occur in the usual mode of conducting it.

When speaking of the time in which stumps may be expected to heal, I think it right to observe, that it should not be our object to heal the parts in the first instance without the formation of matter : it commonly answers better when done in the more gradual manner I have pointed out. When a stump heals suddenly, and the edges of the divided skin adhere by the first intention, the teguments are apt to be puckered and uneven, and the ligatures of the arteries are removed with difficulty. Of this I have had different cases, when such strong adhesive plasters were employed, as kept the edges of the skin in close contact : but when the common court plaster is made use of, or any other composition possessed of the same degree of adhesive property, although the teguments will be prevented from separating to any considerable extent, yet they will readily yield to the retraction that usually takes place on the accession of tension and pain. In this manner, a slight separation is usually produced ; by means of which the ligatures are easily taken out ; any matter that may form is readily discharged ; the corners left above and beneath by the teguments

being drawn together, are much lessened ; and the stump is always left smooth and equal : hence those stumps which take three weeks or perhaps a month to heal, are usually of a better form than those that heal much sooner.

The advantages attending a speedy cure, and covering the stump with skin, are so great, that they need not be enumerated ; but I thought it right to mention the inconveniencies that occur from the union of the divided skin being too quickly connected, either with adhesive plasters, or futures, which last have in some cases been employed.

It will be readily perceived, that the principal difference between this operation and the usual method of amputating, consists in the saving as much of the muscular substance of the limb as will completely cover the bone, together with as much skin as will cover the whole surface of the stump : but it is proper to remark, that we may err in saving more of each of these parts than is requisite, and that some attention is therefore necessary to guard against it. In leaving too much muscular substance, we must necessarily shorten the limb too much, by sawing the bone higher than we otherwise would do ; and by saving too much skin, we render the surface of the stump puckered and uneven.

With respect to the quantity of muscular substance that should be saved, I have hitherto found, that the directions given above, in general answer the purpose. By separating the muscles from the bone for the space of an inch, and sawing it at this height above where it is divided in the ordinary method of amputating, the bone will always be sufficiently covered with flesh ; and a very little experience enables us to judge of the quantity of skin that should be saved for covering the stump : but even when more is saved than is necessary for this purpose, a little attention will enable us to prevent inequalities. By an assistant drawing down the teguments, in the manner I have directed, before

the roller is applied, as much of them may be pulled down as is just necessary ; and if they are kept in this situation till the application of the roller is finished, any inconveniency which might have ensued from too great a quantity will be prevented.

It will likewise be observed, that in making the first incision of the teguments, I have not desired a circular piece of tape to be made use of, as is usually done, to serve as a direction for the knife. This deviation from the common practice has been long adopted by some individuals ; but so far as I know, it was first suggested by the late Dr. Hunter of London ; and I think it a material improvement of this part of the operation : for besides the saving of time, which is always of importance in that state of anxiety to which a patient is reduced who is placed upon a table for the purpose of losing a limb, it in reality puts it in our power to make the incision with more neatness, more speedily, and with less embarrassment, than when the tape is employed. Those who have been accustomed to use the tape will at first be of a different opinion ; but whoever lays it aside, will find, that the circular incision may be made with more exactness merely by following the knife with the eye ; and I am certain that it may be done in one half of the time. When the tape is employed a good deal of time is lost in endeavouring to keep the knife exactly in a line with the edge of it ; and if not applied with the utmost exactness, it necessarily makes the incision ragged and unequal ; an occurrence I have observed in different instances, even with expert surgeons, while I never perceived any inequality where the tape was not made use of.

It has been objected to the operation that I have described, that being more tedious than the usual method of amputating, it must necessarily create more pain. The difference in this respect, however, is trifling ; for it must be remembered, that the incision of the skin, and this is the most painful part in every

operation, is the same in both. The division of the cellular substance is quickly performed, and little or no pain ensues from it; and the third incision, if we may so term it, or the separation of the muscles from the bone, may be performed in the tenth part of a minute. In different instances, I made use of a scalpel for separating the cellular substance from the muscles beneath, as well as for separating the muscles from the bone; but I now find that both these parts of the operation may be done with the common amputating knife, with equal ease and expedition; and we should avoid multiplying instruments, wherever the intention can be answered equally well with a smaller number. The knife delineated in Plate XCVIII. fig. 3. is the one I now prefer, after trying various forms of it: it is of a middling size, somewhat shorter than the one in common use, and perfectly straight. The curved knife is still used by some practitioners, but no good reason has been assigned for it.

If any surgeon should find it difficult to separate the muscles from the bone with this knife, the instrument recommended by Mr. Gooch, and delineated in Plate XCVIII. fig. 4. may be employed.

I shall now describe such parts of Mr. Alanson's method of performing this operation as are peculiar to himself; and in order to convey the meaning of the author with exactness, I shall give it in his own words, from the second and last edition of his book, page 51.

“Apply the tourniquet in the usual way; stand on the outside of the thigh; and let an assistant draw up the skin and muscles, by firmly grasping the limb circularly with both hands. The operator then makes the circular incision as quickly as possible through the skin and membrana adiposa down to the muscles: he next separates the cellular and membranous attachments with the edge of his knife, till as much skin is drawn back as will afterwards, conjointly with the

following division of the muscles, cover the surface of the wound with the most perfect ease.

“ The assistant still firmly supporting the parts as before, apply the *edge* of your knife upon the inner edge of the musculous vastus internus, and at one stroke cut obliquely through the muscles upwards as to the limb and down to the bone ; or in other words, cut in such a direction as to lay the bone bare about two or three fingers breadth higher than is usually done by the common perpendicular circular incision : now draw the knife towards you, so that its point may rest upon the bone, still attending to keep it in the same oblique line, that the muscles may be divided all round the limb in that direction by a proper turn of the knife ; during which its point is kept in contact with, and revolves round, the bone.

“ The part where the bone is to be laid bare, whether two, three, or four fingers breadth higher than the edge of the retracted integuments ; or, in other words, the quantity of muscular substance to be taken out in making the double incision, must be regulated by considering the length of the limb, and the quantity of skin that has been previously saved by dividing the membranous attachments.

“ The quantity of skin saved, and muscular substance taken out, must be in such an exact proportion to each other, as that, by a removal of both, the whole surface of the wound will afterwards be easily covered, and the length of the limb not more shortened than is necessary to obtain this end. However, it is to be observed, that the more muscular substance we save, by fully giving the oblique direction to the knife, instead of dividing the membranous attachments, the better.”

Mr. Alanson now gives some directions for the use of the retractor ; for securing the divided arteries with ligatures ; and for the application of the flannel roller. Afterwards he proceeds thus : “ You are now to place the skin and muscles over the bone in such a direction as that the wound shall appear only in a line with the

angles at each side; from which points the ligatures are to be left out, as their vicinity to either angle directs: the skin is easily secured in this posture by long slips of linen or lint, about two fingers in breadth, spread with cerate or any other ointment: if the skin do not easily meet, it is best brought into contact by slips of linen spread with sticking plaster. These are to be applied from below upwards across the face of the stump, and over them a soft tow pledget and compress of linen, the whole to be retained by the many tailed bandage, with two tails or slips to come from below upwards, to retain the dressings upon the face of the stump."

Mr. Alanfon uses a knife with a double edge, which he thinks preferable to the one commonly employed.

As I wish the author's ideas to be clearly understood I think it right to add, that in p. 17, he directs the bone to be laid bare three or four fingers breadth higher than is usually done by the common perpendicular incision of the muscles; that is, that by the oblique direction of the knife, three or four fingers breadth of muscular substance should be scooped out. And, in page 21, he observes, "that a stump formed in the thigh, agreeably to the foregoing plan, if you bring the parts gently forwards after the operation, and then view the surface of the wound, may, in some degree, be said to resemble a conical cavity, the apex of which is the extremity of the bone;" and the parts thus divided, he observes, are obviously the best calculated to prevent a sugar-loaf stump.

From what has been said, it will appear, that Mr. Alanfon's method of operating differs chiefly from that which I have advised above, in the manner of dividing the muscles, and in the after position of the skin. Every surgeon is apt to be partial to that mode of operating which he has been accustomed to practise; but being always anxious to have this very important operation improved to the highest possible degree, I was resolved to give Mr. Alanfon's method a

fair trial, being hopeful, from the accounts received of it, that I should find it answer better even than that of which I have spoken so highly. I can with truth, however, assert, that it did not answer my expectation. The stumps formed by it are, indeed, much better than can be made by the usual method of amputating; but the removal of such a large portion of muscular substance, as is done by Mr. Alanson's oblique incision, produces a hollow, that not only retains the matter, but prevents the stump from being so smooth and equal as when the skin is supported by a flat muscular surface in the manner I have advised. Mr. Alanson, who is in the daily practice of it, may be able to obviate these difficulties; but I know that I cannot make such a good stump in this manner as I always do in the other method of operating; nor is Mr. Alanson's own idea so completely answered by his method of operating. He very properly observes, page 36, that in the thigh we want a sufficient cushion between the bone and machine to be used in walking; that the more muscular substance that is saved, the farther will the point of bone on which the pressure principally produces inconvenience, be removed from the surface of the machine; and likewise, that a more vigorous circulation will be kept up all round the extremity of the bone and stump, which lessens the danger of exfoliation. Now, it is obvious, that the end of the bone will not be so much covered with muscular substance when a considerable portion of the muscles is removed by the oblique incision as when they are allowed to remain; nor will the circulation be so vigorous round the end of the bone.

But admitting Mr. Alanson's method of operating to be in every point equal to the other, the greater difficulty of performing it is a weighty objection against it. Indeed few, I believe, will be able to divide the muscles by the oblique incision without mangling the skin, even with the explanation given by Mr. Alanson in the last edition of his book. Accordingly we find,

in page 204, that this actually happened in the hands of an expert surgeon, Mr. Lucas of Leeds, even where the division of the muscles was not begun close under the retracted integuments, but a little lower. Nor will this be an uncommon occurrence, if the muscles are divided with the edge of the knife, as is directed by Mr. Alanfon. I have divided them with the point of the knife, but with difficulty ; for the point cannot be easily carried round to the height of three or four fingers breadth above the retracted skin, so as to make a smooth equal cut. I do not see how the edge of the knife can be applied to cut so obliquely upwards without hurting the skin ; and yet Mr. Alanfon's words are, " apply the edge of your knife, and at one stroke cut obliquely through the muscles," &c. He desires, indeed, that the incision may be finished with the point ; but I do not understand how it can be done without cutting the skin, if the point be not employed from first to last in the division of the muscles. Indeed, Mr. Alanfon himself admits that there is difficulty in this part of the operation ; for in page 18, he says, " that, while one assistant continues a firm and steady elevation of the parts, another should attend to preserve the skin from being wounded as the knife goes through the muscles at the under part of the limb." This, of itself, appears to be a material objection to this method of operating : for two assistants, whose hands are all employed nearly at one point, must be apt to embarrass not only each other but the operator : and besides, it must often happen, that two assistants cannot be procured.

With respect to the line of direction in which the wound should be closed, Mr. Alanfon observes, page 67, if it be formed from above downwards, the cicatrix will generally be found directly opposite to the bone ; by which, in walking with an artificial leg, the point of pressure must be upon the new formed skin ; which he thinks will be avoided by forming the line in the contrary direction from side to side : in which

case, after the cure is complete, it will be found, that in consequence of the more powerful action of the flexor muscles, the cicatrix is drawn downwards, and the extremity of the bone is therefore covered with the old skin ; by which the greatest pressure falls upon this part, and not upon the new formed skin.

I have not found, however, that this argument is of much importance ; for this retraction of the flexor muscles to which Mr. Alanson alludes, is in a great measure owing to the custom of elevating the stump after the operation, and may be prevented by keeping it lower than the rest of the body, in the manner I have mentioned. And besides, the bone is so well covered with muscular substance, and the cicatrix so narrow when the operation is rightly done, that I have not met with a single instance of any inconvenience arising from this circumstance mentioned by Mr. Alanson : whereas, the lodgment of matter proves always so troublesome and pernicious, and would in all probability occur so frequently, were the practice generally adopted of making a transverse opening instead of a longitudinal one upon the face of the stump, that this appears to be a sufficient reason for preferring the former.

With a view to prevent that inequality on the surface of the stump, which arises from the retraction of the flexor muscles of the thigh, I have in some cases divided these muscles an inch lower than those of the rest of the limb. After dividing the skin and cellular substance with a circular incision in the usual way, this is easily done ; and it prevents this inconvenience in the most effectual manner : but it is not necessary when the stump is treated in the manner I have mentioned.

Whether others may deem these observations upon Mr. Alanson's method of amputating important or not, I cannot determine ; but as they appeared to me to be of consequence, I thought it my duty to offer them.

It is but justice, however, to remark, that the public is much indebted to Mr. Alanson for his assiduity in endeavouring to improve this very important operation, and for the many useful practical remarks contained in his publication.

SECTION V.

Of Amputating the Leg.

IN amputating the thigh I have observed, that as much of the limb should be saved as can be done with safety; for the longer the stump the more utility is derived from it: but in amputating the leg, it has hitherto been a general rule to take it off a little below the knee, even where the disease is seated on or near to the ankle, and where accordingly the operation might be performed much lower. The reason given for this is, that a few inches of the leg being saved, answers as a sufficient rest to the body in walking when the limb is inserted into the box of a wooden leg; and when much more of it is left, that it proves troublesome both in walking and sitting, without being attended with any particular advantage.

Were we to conclude, that the common practice of bending the joint of the knee and resting upon the anterior part of the leg was necessary, this method of operating a little below the knee would be admitted as the best: but as we have now had many instances of patients walking equally well with machines, so contrived as to admit of the use of the knee joint; as these machines, by resembling the human leg, are much more pleasing to the eye than the wooden ones in common use; and as the operation may be done with much more ease and safety to the patient a little above the ankle, I am of opinion that it should always

be done here whenever it is practicable, instead of the ordinary place a little below the knee.

The operation is easier performed a little above the ankle than at the upper part of the leg, by the parts to be divided being less extensive ; for the diameter of the leg is here considerably less ; and it is done with more safety by our being able to cover the bone more completely with soft parts, so as to accomplish a cure in the same manner and equally soon as in the thigh : whereas, immediately below the knee, the bones are not only larger, but there is such a scarcity of soft parts, that the cure proves always much more tedious, notwithstanding all our endeavours to promote it ; in-somuch, that in operating at the usual place, about four inches beneath the patella, the sore, with all the attention we can give to it, will seldom heal in less than ten or twelve weeks ; and in the common method of forming the double incision, it will even require four or five months : whereas, when the operation is rightly performed a few inches above the ankle, a cure may, for the most part, be effected in a fortnight or three weeks.

It is true that a method of amputating beneath the knee has been proposed, by what is termed the flap operation, and by which a cure may be more speedily obtained than in the usual way of operating ; but still it is tedious, and at the same time liable to other objections, which I shall have presently occasion to mention. I therefore conclude, that in every case that admits of it, amputating a little above the ankle is preferable to operating immediately below the knee.

We are next to determine the most proper place for the operation, when we are prevented by the extent of the disease in the leg from amputating lower than the usual place beneath the knee. Where the upper part of the leg is sound, it has hitherto been a fixed maxim to amputate below the joint of the knee rather than above it.

While practitioners were unacquainted with the present improvements on this operation, they seem to have adopted this maxim, chiefly from finding that the body rested more easily upon the sound skin on the forepart of the leg than on the stump of the thigh : but now that the operation, when done above the knee, may be so performed that the sore will heal in less than one half of the time that is required when the leg is taken off immediately below the joint ; and in such a manner that the stump is covered with sound skin, as well as with some muscular substance, which admits of the patient resting upon it with freedom ; this reason, upon which the practice is chiefly founded, falls to the ground.

I have observed above, that the cure of a stump immediately below the knee is always tedious, owing to the great extent of bone at this place, and the natural deficiency of soft parts.

Upon the whole, therefore, I conclude, that amputation immediately below the knee should seldom or never be advised : but as no innovation will at first be generally admitted, I think it right to describe the method of operating when it is determined to amputate at this part.

The patient should be placed upon a table and secured in the same manner as in operating above the knee. The tourniquet should be applied a little above the knee, with the cushion upon the artery in the ham. The foot and leg should be secured by an assistant sitting before the patient, while the teguments are drawn up by another assistant towards the knee. The surgeon, standing on the inside of the leg, should now with the knife, Plate XCVIII. fig. 3. make a circular cut through the skin and cellular substance down to the muscles, so far down upon the limb, that when as much of the teguments are separated from the parts beneath as will cover the stump, the muscles and bones may be divided immediately below the insertion of the flexor tendons of the leg. The interosseous soft parts

must be divided either with the point of the amputating knife or with the catline, Plate XCVIII. fig. 2. The retractors, Plate XCVII. fig. 2. and 3. must now be applied so as to support and protect the skin and other soft parts from the saw employed for dividing the bones. This being done, and the vessels secured in the usual way with ligatures, the teguments should be drawn over the stump and retained with adhesive plasters, in the manner I have advised in amputating the thigh. The practice, indeed, should be the same during the whole course of the cure ; only, in the application of the flannel roller, there is no necessity for beginning at the top of the thigh : it should receive, however, two or three turns above the knee, to prevent it from slipping down.

In separating the adhesions of the skin from the parts beneath, as much of the cellular substance should be taken along with it as can be got ; otherwise the circulation in the skin itself is apt to become so languid as to prevent it from adhering to the parts on which it is applied. It will be found too, that more attention is necessary to destroy the attachments of the skin in this situation, particularly on the forepart of the leg, than in the thigh, owing to the cellular substance being more condensed where it lies so contiguous to the bone, than in the thigh, where the muscles intervene. And as this state of the cellular membrane prevents the teguments from retracting freely after they are divided ; and as they cannot even be pulled sufficiently up by the assistant, it is necessary to fold such of them as are separated from the parts beneath, back upon the sound skin, before the division of the muscles is attempted ; otherwise the skin will either be cut with a knife, or the muscles will not be divided so high as they ought to be.

Always at this part of the leg, and in a few cases immediately above the ankle, I have found it necessary to fold the skin back in this manner ; but hitherto no instance has occurred in the thigh, where the operation

might not have been done merely by pulling the teguments up, in the manner I have formerly mentioned.

I have desired above, that in this operation the surgeon should stand on the inside of the leg: by this, if the knee and foot are turned inwards, so as to raise the fibula, the saw may be applied in such a manner to both bones as to divide them nearly together, the surest method of preventing them from breaking when nearly sawn through: whereas, on standing on the outside of the patient, the fibula is more apt to be left to the last; at the same time that the saw is applied upon the ridge of the tibia, so as to act upon its longest diameter, by which it is not so quickly divided.

In operating above the ankle, that spot should be fixed upon that will leave the stump of the most convenient length for being fitted with a leather machine resembling the other leg. And I find from observation, as well as from information obtained from Mr. Wilson, a late ingenious tradesman of this place, that nine inches from the joint of the knee is the best length for this purpose; for it affords a sufficient support to the machine, and at the same time prevents it from being so heavy and clumsy as when the leg is left of a greater length: for when taken off immediately above the ankle, the stump must go down to the very bottom of the machine, which must therefore be thicker and heavier at the ankle than it otherwise might be; at the same time that it will not correspond so exactly as it otherwise would do to the size of the other leg.

In addition to what I have said upon the method of amputating the leg immediately below the knee, I may observe, that, in operating above the ankle, it should be done exactly as I have advised in describing the amputation of the thigh: only in this situation, instead of muscles, we find a portion of both bones covered merely with skin and cellular substance; but as the cellular membrane is here commonly sufficiently lax,

and in greater quantity than in the upper part of the leg, it is not only more easily separated from the periosteum, but serves to give the bones a more complete covering: by which, when the operation is properly done, the cure for the most part is accomplished in less than three weeks, and the surface of the stump is equal, and every where covered with sound skin.

SECTION VI.

Of Amputating with a Flap.

IN amputating in the usual way, the cure was so extremely tedious; the health of the patient was thereby so much injured; and the stumps, when healed, were so pyramidal, and so thinly covered with soft parts, that another method of operating, as I have observed above, was proposed upwards of a hundred years ago; in which an attempt was made to obviate these difficulties, by preserving a flap of muscles and skin for the purpose of covering the stump.

This was first proposed by one Loudham, a British surgeon: it was afterwards practised in Holland, Germany, Switzerland, and France; and more lately by some individuals in Britain and Ireland: but it has never been received into general use, nor is it probable that it will ever be frequently performed.

The chief objections to it were, the difficulty of restraining hemorrhagies when they happened to recur after the flap was applied and fixed in its situation with futures, for in order to discover the bleeding arteries, it was necessary to undo the whole; the flap not adhering uniformly over the whole surface of the stump; and the pain, inflammation, and tension, that supervened to this operation, being much more severe than after the usual method of operating.

To remove these difficulties, it was proposed, about forty years ago, by Mr. O'Halloran, an ingenious surgeon of Limeric, to dress the stump and flap as separate sores for the first twelve days; when the risk of hemorrhagy being over, the symptoms of pain, inflammation, and tension, subsided, and suppuration established, we are directed to turn the flap back upon the surface of the stump, and by means of plasters, compression, and bandage, to secure it in this situation till they unite.

By this improvement the operation was rendered more safe and certain; and it is probable that it would gradually have come into general practice, if the improved method of operating, that I have already described, had not in the mean time been introduced: but although this will probably continue to be generally preferred, yet in particular situations, the operation with the flap may with much propriety be employed. Wherever the divided parts cannot be properly covered with skin in any other manner, it ought certainly to be done with a flap: and this will always be the case in amputating the arm at the shoulder, and the thigh at the hip joint, as well as in removing any of the fingers or toes: it may likewise by some be preferred to the method of operating that I have described, when it is resolved to amputate immediately below the knee; for the teguments being in this part extremely thin, the stump cannot in any other manner be sufficiently covered. But for the reasons that I have given, it can never be necessary, either above the knee; immediately above the ankle; nor in the arm or fore-arm. Some, however, may continue to prefer it, even in these parts; so that it will be proper to describe the method of doing it in all of them; which I shall therefore do in the following Sections.

SECTION VII.

Of Amputating at the Hip Joint.

THE amputation of the thigh at the hip joint has always been considered as one of the most hazardous operations : it has therefore been very seldom performed. Indeed surgeons in general have spoken of it as one of those operations which authors might describe, but which would never be practised ; and when we consider the great size of the blood vessels which supply these parts : the difficulty of commanding the hemorrhagy during the operation ; and the very extensive wound which, in the usual method of operating must necessarily have ensued here ; we will not be surpris'd at the aversion that has generally prevailed against it.

But if these difficulties can be removed ; if danger from hemorrhagy can be prevented during the operation, as well as afterwards ; if the sore can be so completely covered with skin as to be healed in the course of a few weeks ; and if cases ever occur that would otherwise end in the death of the patient ; we surely would not hesitate to advise it. Now, I hope to make it appear, that the operation may be done with very little loss of blood ; and that as much skin may be saved as will cover the sore entirely : and no practitioner will doubt of diseases taking place at the top of the thigh, which cannot be removed but by amputating the limb.

Having already treated fully of the causes by which amputation of limbs may become necessary, I shall now refer to what was said upon that part of the subject ; and at present I shall only observe, that gunshot wounds, accompanied with fractures of this part of the bone, spina ventosa, or caries of the head of the femur, will be the most frequent causes of amputating at the joint of the hip. When the operation is

to be performed, it may be done in the following manner.

The patient should be placed upon a table ; and it will be found that the parts that are meant to be divided will be brought most clearly into view by laying him on the sound side. In this situation he should be secured by two or three assistants, while another assistant takes the management of the limb.

Let a small pad or cushion be now placed upon the femoral artery, immediately after it passes out from beneath Poupert's ligament into the thigh ; and, by means of a tourniquet applied as near as possible to the top of the limb, let the circulation be completely stopped. Let the skin, *membrana adiposa*, and *tendinous facia* of the thigh, be divided by a circular incision six inches from the top of the thigh ; that is, at least three inches beneath the circular band of the tourniquet. Let the retracted skin be pulled an inch upwards ; and at the edge of it let the amputating knife be applied, so as with one perpendicular circular stroke the muscles may be cut down to the bone. If the muscles are freely divided, they will retract so much as to admit of sufficient space for securing not only the femoral artery but all the muscular branches. This being done, take a strong round edged scalpel, larger than the common size, and commencing at the upper edge of the circular cut on the posterior part of the thigh, make a deep incision down to the bone, and carry it up of the same depth to a little above the great trochanter into the joint. Let a similar cut be made on the opposite side of the limb, at a sufficient distance from the femoral artery, and completely down to the bone. Let the two portions of flesh be now dissected from the bone, and the flaps formed by them be taken care of by assistants, while any artery that may be cut should be tied as soon as it is observed. The joint being laid bare, some dexterity is required to disengage the head of the femur from the acetabulum ; for it is rendered difficult by being tied

down with the *ligamentum rotundum* : but by turning the bone in different directions, and particularly by pressing it inwards, where it yields most readily from the brim of the *acetabulum* being lowest, the head of it may be so far turned out of the socket on the opposite side as to admit of the ligament being reached with the point of a scalpel or a firm probe pointed bistoury ; but to accomplish this, the muscles must all be previously detached from the bone.

The head of the bone being taken out, and the limb removed, we may examine the state of the *acetabulum* : for if it is found, our prospect of a cure will be more favourable than if any part of it were carious. But in whatever state the bones may be, our treatment of the fore must be the same : we must endeavour to cure it as nearly as possible by the first intention : for which purpose, after removing all the coagulated blood from the surface of the wound ; placing the muscles as nearly as possible in their natural situations ; and drawing the two flaps together, so as to cover the fore as neatly as may be, they should be secured in this situation with three or four sutures introduced at the most proper points ; by adhesive plasters ; and by proper compresses retained with a broad flannel roller passed different times round the body, and spirally over the stump ; care being taken to leave the ligatures upon the arteries of a sufficient length to admit of their being afterwards drawn out.

The patient should now be laid in bed, and treated in other respects as I have advised in general after the operation of amputation : only it must be remarked, that more than ordinary attention is required to prevent and remove such febrile symptoms as usually succeed to amputation ; for where such a considerable part of the body is suddenly taken away, almost a fourth part of the whole, we may reasonably conclude that the effect produced by it upon the system must be considerable. If the patient is plethoric, it will be proper to diminish the quantity of blood ; in the first

place by venesection, and afterwards by a low diet : indeed moderate living should be persevered in, if not for life, at least for a great length of time.

The dressings may be removed at the usual time, and in the course of ten or twelve days the ligatures may be all taken away ; at which time, any part of the fore that remains open may be covered, by drawing the skin over it, and securing it with adhesive plaster. In such an extensive fore, it is indeed probable that matter may collect in different parts beneath the skin ; for the pressure applied upon it, will not be so equal as in common cases of amputation : but the inconvenience arising from this will not be great ; for if the matter cannot be discharged by altering the pressure, it will be easily done with the point of a lancet, by which this obstruction to the cure will be removed.

At all times this will necessarily be considered as a very formidable operation ; but when performed in the manner I have advised, much of the hazard, and many of the inconveniencies usually supposed to attend it, will be removed : nor should any practitioner accustomed to operate, hesitate in performing it, when the life of a patient will otherwise be endangered. By the tourniquet, we effectually command the circulation in the limb till all the large blood vessels divided by the circular incision are tied ; and by securing the different arteries that are cut in making the longitudinal incisions as soon as they appear, the loss of blood will be inconsiderable : nor will there be any risk of hurting the femoral artery in the course of separating the flap in which it is seated from the bone, if it is done with caution.

It may be alleged, that by this method of operating, more of the teguments and muscles will be saved than are necessary for covering the fore ; but it must be remembered, that the fore will here be very extensive, and that the divided muscles will retract considerably. And besides, the tourniquet could not be applied if

the first cut was much higher than I have directed ; by which the operation would necessarily be rendered much more dangerous : nor can any risk ensue from the teguments and muscles being left somewhat longer than might just be necessary, while much inconvenience would arise from their being deficient.

In the sixth volume of the Medical Commentaries of Edinburgh, a case is recorded, in which the thigh was amputated at this joint by Mr. Kerr, surgeon in Northampton. In this case, the division of the femoral artery was reserved to the last ; nor was the tourniquet employed. No hemorrhagy indeed occurred ; but there was surely more risk of this than if the operation had been done in the manner I have advised : nor could the operator use such freedom with the bone, in removing the head of it from the socket, as long as the blood vessels remained undivided. I may remark, however, that this case affords an instance of this operation being practised with safety : for although the patient died, yet she lived eighteen days after the operation, and at last died from a different cause, when all risk of hemorrhagy was over, and when the sore had even a favourable appearance.

SECTION VIII.

Of the Flap Operation immediately above the Knee.

WHEN this operation is to be performed above the knee, it may be done either with one or two flaps, but it will commonly succeed best with one. The flap answers best on the forepart of the thigh ; for here there is a sufficiency of soft parts for covering the bone, and the matter passes more freely off than when the flap is formed behind.

The patient being placed upon a table, the tourniquet being applied in the usual way at the top of the

thigh, and the teguments drawn firmly up and retained by an assistant, the extent of the intended flap should be marked with ink. A person much accustomed to this operation may not require this assistance; but it will be done with more neatness and accuracy if the form and extent of the flap are previously marked.

The extreme point of the flap should reach to the end of the limb, unless the teguments are in any part diseased; in which case, it must terminate where the disease begins, and its base should be where the bone is to be sawn. This will determine the length of the flap; and we should be directed with respect to the breadth of it by the circumference of the limb: for, the diameter of a circle being somewhat more than a third of its circumference, although a limb may not be exactly circular, yet by attention to this, we may ascertain with sufficient exactness the size of a flap for covering a stump. Thus, a flap of four inches and a quarter in length will reach completely across a stump whose circumference is twelve inches; but as some allowance must be made for the quantity of skin and muscles that may be saved on the opposite side of the limb, by cutting them in the manner I have directed, and drawing them up before sawing the bone; and as it is a point of importance to leave the limb as long as possible, instead of four inches and a quarter, a limb of this size, where the first incision is managed in this manner, will not require a flap longer than three inches and a quarter, and so in proportion according to the size of the limb. The flap at its base should be as broad as the breadth of the limb will permit, and should be continued nearly, although not altogether, of the same breadth to within a little of its termination, where it should be rounded off so as to correspond as exactly as may be with the figure of the fore on the back part of the limb. This being marked out, the surgeon standing on the outside of the limb should push a straight double edged knife with a sharp point to the depth of the bone, by entering the

point of it at the outside of the base of the intended flap ; and carrying the point close to the bone, it must here be pushed through the teguments at the mark on the opposite side. The edge of the knife must now be carried downwards, in such a direction as to form the flap according to the figure marked out ; and as it draws towards the end, the edge of it should be somewhat raised from the bone, so as to make the extremity of the flap thinner than the base ; by which it will apply with more neatness to the surface of the fore. The flap being supported by an assistant, the teguments and muscles of the other parts of the limb should, by one stroke of the knife, be cut down to the bone about an inch beneath where the bone is to be sawn ; and the muscles being separated to this height from the bone with the point of the knife, the soft parts must all be supported with the leather retractors, Plate XCVII. fig. 4. till the bone is sawn, and any splinters that may be left, are cut off. All the arteries that discharge much blood must now be secured in the usual way with the tenaculum, the ligatures being left of a sufficient length for hanging out at the edge of the flap.

The skin and muscles should now be drawn down and secured with a flannel or cotton roller, in the manner I have advised when a leg is amputated with a circular incision ; and the flap may now be laid down over the surface of the fore, so as to effect a cure as much as possible by the first intention ; or it may be dressed as a separate fore, agreeably to the practice of Mr. O'Halloran, according to the judgment of the operator. If the flap is to be applied immediately, the coagulated blood should be carefully sponged out, and it should be secured to the muscles and teguments surrounding the rest of the stump by three or four sutures passed at least three quarters of an inch into the muscular part of it : but care should be taken not to draw the ligatures so tight as to create much irritation or pain. The under part of the stump should now be

covered with a large pledget of common cerate ; and a cushion of soft tow being laid over it, the whole should be secured in the manner I have formerly advised, with cross straps of linen and a few turns of a circular roller.

In three or four days, the dressings may be renewed ; and as soon as the ligatures are all removed, and the tension and inflammation induced by the operation abated, any part of the fore that was not covered at first may now have the skin drawn over it, and secured with adhesive plasters.

But if Mr. O'Halloran's method is to be adopted, the easiest mode of proceeding is this. The muscles and teguments being drawn down and secured with the roller, let the whole surface of the stump be covered with a pledget of soft lint spread on both sides with any soft emollient ointment : let the flap be laid down upon this ; and another pledget of the same kind being laid over the whole with a cushion of tow and a compress of soft linen, the cross straps and circular roller should be employed to support them, but with gentle pressure. At the end of three or four days, the dressings may be renewed in the same manner ; and about the twelfth or fourteenth day, or whenever the tension induced by the operation is removed, the ligatures being all taken out, and a proper suppuration established, the flap may be brought into contact with the fore beneath with a view to make them unite. For this purpose, any matter that may be observed upon the surface of either of them should be gently removed with a soft sponge ; and the flap being laid down with as much exactness as possible, it may either be secured with adhesive plasters supported by the bandage above mentioned, or two or three futures may be employed for it. This last method will give more pain than the other ; but this will be amply compensated by the flap being retained with more accuracy in its situation.

Farther experience must evince which of these me-

thods should be preferred, for as yet it is not determined. It is my own opinion, that the secondary union recommended by Mr. O'Halloran is the best: for the pain, tension, and inflammation that ensue from the other, run often so high as to render it necessary to remove the dressings and even the ligatures; by which much additional trouble is given to the practitioner, and much distress to the patient: whereas, when the tension and inflammation are gone before the flap is laid down, little or no pain is induced by it; nor is the cure effected in this manner more tedious: on the contrary, it would appear to be in general accomplished more quickly in this way than in the other. Even where the flap has not been applied to the fore till the fourteenth day, the cure has been completed before the fourth week: whereas, few, if any, cures, have been effected so early where the flap was applied immediately after the operation.

In operating with two flaps, the following is perhaps the easiest method: the patient being placed upon a table, and the tourniquet applied, let the skin be drawn up by an assistant, and a circular incision made through the teguments and muscles down to the bone at the inferior part of the limb, with the edge of the knife turned obliquely upwards: let the sharp pointed knife, mentioned above, be now pushed through the skin and muscles on one side of the limb down to the bone, at that part where it is to be sawn; and the under edge of the knife being turned obliquely outwards, let the muscles be divided down to the circular incision. The teguments and muscles on the opposite side of the limb must now be divided by a similar incision, when any of the intermediate soft parts that may have been left must likewise be cut; and the bone being sawn, and the vessels secured with ligatures, the cure may either be attempted by laying the flaps together immediately, or they may be kept separate twelve or fourteen days, and treated afterwards in the manner I have advised above.

SECTION IX.

Of the Flap Operation below the Knee.

IN speaking of this operation below the knee, it is not necessary to describe all the steps of it. The views of the operator are the same here as in operating above the knee, and the method of effecting them is nearly similar. After the previous steps of the operation are taken, the size and form of a flap sufficient to cover a considerable part of the fore must be marked out with ink, and this must be separated from the parts beneath in the manner I have already advised: the rest of the soft parts must now be divided, taking care to save as much of the teguments on the side of the limb opposite to the flap as with the flap itself will nearly or entirely cover the fore; and the cure must afterwards be conducted, either by applying the flap immediately, or after the symptoms of pain, tension and inflammation induced by the operation are gone, and treated in the manner advised in the last section.

It must be observed, however, in operating beneath the knee, that the flap cannot be formed on the forepart of the limb as is done in the thigh; for on this part of the leg there is no muscular substance; and for this reason, we are advised by authors to form the flap on the back part of the leg. But this is liable to one very important objection, the difficulty of preventing matter from lodging between the flap and the fore after they are brought in contact; for it must be remarked, that it is moderate pressure only that we dare venture to apply to the flap; so that it is scarcely possible to prevent the matter from collecting where it does not find a free vent below.

Instead of forming the flap from the muscles of the back part of the leg, it may be done with more propriety upon the outside of the limb, where there is a

sufficient quantity of muscular substance for this purpose. The point of the knife should be entered on the outside of the ridge of the tibia at the part where the bone is to be sawn; and being carried backwards in a direct line, and at a proper depth to the opposite side of the base of the flap, the edge of it must afterwards be carried down the line previously marked with ink as a direction for the form and length of it. In this manner the bones may be covered with a flap sufficiently thick, while the matter that forms in the progress of the cure, finding a ready outlet by the inferior edge of the flap, will not readily lodge.

In operating immediately above the ankle, we are under the necessity of leaving the flap behind, for there is not a sufficiency of soft parts to admit of it in any other part. But I have elsewhere observed, that the leg should never be taken off so immediately above the ankle, as it leaves the stump too long for a machine to be rightly fitted to it for walking: but at nine inches from the condyles of the femur, which in an adult is the most proper length for this purpose, the flap may with propriety be formed, in the manner I have mentioned, on the outside of the leg.

SECTION X.

Of Amputating the Foot, Toes, and Fingers.

WHEN the whole foot is diseased, it becomes necessary to take off the limb at the part I have mentioned above the ankle; nay, this should be done even where the parts about the joint are sound, if all the rest of the foot is diseased: for although some have advised the foot to be amputated at the joint of the ankle, yet the practice should not be adopted, as the sore cannot be properly covered, nor is the stump when of this length so useful: but when a considera-

ble part of the foot remains sound, it ought undoubtedly to be saved, and the diseased part of it only removed. I have seen a whole foot taken off, where two of the metatarsal bones only were diseased : while, on the contrary, it should be held as a fixed rule, to remove the diseased parts alone, even where two of these bones only remain sound ; for with the assistance of a shoe properly stuffed, and a firm unyielding sole, even a very small part of the foot proves useful in walking ; especially when the bones on the inside of the foot, or those corresponding to the great toe, and those next to it, are left.

When the middle part only of the foot is diseased, the metatarsal bones on each side remaining sound, these should be left, and the diseased part only taken out. In this case, the bones should be taken out at the joint, whether they are diseased through their whole length or not ; for although instruments might be invented for cutting even a single bone across in the centre of the foot, the operation would necessarily be much more tedious, and more painful, than the removal of the bone at the joint, at the same time that little or no advantage would be derived from saving a small portion at the end of it. But where one, two or three of the bones on either side of the foot are only partially diseased, as in this case it becomes an object to save as much of the foot as possible, the operation should be so conducted that the bones may be sawn across nearly at the termination of the diseased parts.

In every case of amputation, it is an object of importance to save as much skin as will cover the fore ; especially in amputating any part of the foot where the effect of friction is much to be dreaded in walking. In making the incision, therefore, at that part of the bone where the saw is to be applied, it should be done in such a manner, that a flap may be saved of a sufficient size for covering the fore. With proper attention this may always be done, nor is it often

difficult : for the flap may be formed either above or below, or on one side of the toe, according as the teguments are found or otherwise. But it is proper to remark, that where the skin is found, it answers best to save it below, for in this situation it is firmer, and therefore more able to resist the effects of pressure.

This operation is most easily performed when the patient is placed upon a table. The tourniquet should be applied above the knee, with a compress placed upon the artery in the ham : the limb should be firmly secured by assistants ; and on sawing the bone, a piece of pasteboard, or thin splint of timber, should be inserted between it and the contiguous sound bone, to protect the latter from the teeth of the instrument.

The diseased parts being removed, and the divided arteries secured, the flap should be applied as exactly as possible to the fore, and retained with slips of adhesive plaster and gentle pressure with a flannel roller. If futures are employed, they should be inserted in such a manner as to avoid the flexor and extensor tendons of the toes and foot.

In amputating the toes and fingers, the operation was formerly done by one stroke with a chisel and mallet ; but this is liable to many objections, and has been long in disuse. In general, fingers and toes are amputated in the same manner with the larger extremities, either by preserving a flap sufficient for covering the fore, and afterwards dividing the bone with a small spring saw, represented in Plate XCVII. fig. 1. or by the double incision, performed in the manner I have advised in Section IV. of this Chapter. But instead of this, it has for several years been the practice of some individuals, to amputate fingers and toes at the joints ; and whoever will give it a fair trial, will readily prefer it. The patient being placed upon a table, and the limb properly secured, a flap should be marked with ink of a sufficient size for covering the fore. This being dissected from the bone with a scalpel, and supported by an assistant, a circular incision

is then made through the rest of the soft parts a little below the joint, and on a line with the base of the flap. The lateral ligament is now to be cut; and in order to determine the point at which this should be done, an assistant should be directed to move the finger. This ligament being divided, the bones are easily dislocated, when the remainder of the operation may be quickly finished. If an artery is to be tied, it should be done with the tenaculum. The flap must be applied to the fore, and secured as neatly as possible with adhesive plasters, and moderate pressure with a flannel roller.

The only objection that has been made to this practice is, the supposed uncertain union of the contiguous soft parts with cartilage. But we now know, that there is no cause for this apprehension, and that a flap will unite as readily with cartilage as with bone, at least I have uniformly observed this to be the case; and we find from Mr. Alanson's publication, that the practice has proved very successful in the course of his experience.

SECTION XI.

Of Amputating the Arm at the Joint of the Shoulder.

THIS operation having always been considered as hazardous and difficult to perform, it has not frequently been attempted: but although it should never be advised when our purpose can be accomplished by amputating lower, yet no practitioner of modern times will decline it, when the life of a patient cannot in any other manner be saved. Abscesses in the joint, caries of the humerus reaching to the joint, compound fractures extending to the head of the bone, gunshot wounds and mortification, may render amputation of the arm at the shoulder necessary.

The operation may be performed with safety by any surgeon of steadiness and experience, and who is possessed of an accurate knowledge of the anatomy of the joint and contiguous parts.

It may be done in different ways; but the following I believe to be the best.

The patient should be placed upon a table of a convenient height, covered with a mattress and blanket; and he should be laid upon his back, and properly secured by assistants, as near as possible to one side of the table.

The next object is to guard against hemorrhagy: for this purpose the tourniquet might be placed upon the upper part of the limb, in a manner similar to what I have proposed in amputating at the hip joint. But here it is unnecessary, as the blood may be completely stopped in its flow to the arm, by compressing the subclavian artery as it passes over the first rib: for this purpose, an assistant should be properly placed with a firm cushion or compress applied upon the course of this artery directly above the clavicle, who with his finger should make such a degree of pressure as may be required: it will readily be known whether it answers or not, by its influence on the pulse at the wrist.

The circulation being stopped, the diseased shoulder should be made to project somewhat over the side of the table; and the arm being stretched out and supported by an assistant at nearly a right angle with the body, a circular cut should be made through the skin and cellular substance just at the insertion of the deltoid muscle into the humerus. The teguments may be allowed to retract about half an inch; and at the edge of the retracted skin, the knife may be applied so as to divide the muscles with a perpendicular circular cut down to the bone. Thus far we proceed with the common amputating knife; but the remainder of the operation should be finished with a scalpel. With a

firm round edged scalpel a perpendicular incision should now be made down to the bone, commencing at the acromion, about half way between the centre of the deltoid muscle and the inner edge of it, and terminating in the circular incision about an inch above or rather on the outside of the brachial artery. This being done, a similar cut must be made on the back part of the arm, commencing at the same height with the other, and ending in the circular incision. This should be at such a distance from the first, that the two flaps formed by them both may be nearly of an equal breadth. The brachial artery should be tied as soon as it is cut by the circular incision through the muscles; and any anastomosing muscular branches of arteries that may be cut on the upper and back part of the joint, should be tied immediately on being observed. The two flaps should now be separated from the bone, care being taken to avoid the large artery in dissecting off that part of the flap with which it is connected. An assistant must support the flaps so as to bring the capsular ligament of the joint into view; when an opening being made into it, the head of the bone will be easily dislocated by drawing the arm backward; and this being done, the operation will be easily finished, by dividing the remaining part of the ligament.

Any arteries that may have been cut about the joint being tied, the ligatures hanging out at the most depending part of the wound, and the parts cleared of coagulated blood, the two flaps should be laid together so as to cover the joint as neatly as possible, and retained in their situation with two or more sutures. A pledget of lint spread with any emollient ointment should now be laid over the joint; and a soft cushion of tow or lint, with a compress of old linen, being applied over the whole, a flannel roller should be employed to make moderate pressure upon the joint; by which the flaps will be kept in contact with the parts beneath, which will not only facilitate their union, but

will be the most effectual method of preventing the lodgment of matter.

In other respects, the patient should be treated as I have advised in the preceding sections when speaking of amputation in the lower extremities. With a view to prevent any risk from hemorrhagy after the operation, an assistant of experience should sit with the patient for the first two or three days, with directions to apply pressure above the clavicle in the event of any considerable quantity of blood being discharged, till the bleeding vessel can be secured with a ligature. In the course of eight or ten days, the ligatures upon the arteries will come easily away. If matter collects beneath any part of the skin, it must be discharged; and if the patient is healthy, and no untoward circumstance happens, a cure may soon be expected.

Till of late, it was the practice in this operation to tie the brachial artery and veins with a ligature before proceeding farther. This gave much unnecessary pain, at the same time that it did not render the patient more secure. In the way I have mentioned, the operation may be performed with no risk from the hemorrhagy; and by tying the artery at the extremity of the flap, several muscular branches will be saved that would be destroyed by tying it near the axilla.

Mr. Bromfield, in the first volume of his *Observations and Cases*, has given the best account yet published of this operation. The principal difference between his method of doing it and the one that I have described, consists in the latter being more simple, and therefore more easily performed. By dividing the muscles down to the bone with a circular incision, the operation is more speedily done than by cutting first one muscle and then another, in the manner mentioned by Mr. Bromfield. And as the attachments of the latissimus dorsi, the deltoid and pectoral muscles, are removed by the arm being taken away, there is no necessity for proceeding with slowness and caution in

dividing them ; nor is it necessary to employ two ligatures upon the brachial artery, one considerably higher than the other, as is advised by that author ; one ligature applied in the usual way with the tenaculum is quite sufficient, if it is done with care and attention. And Mr. Alanfon very properly observes, in speaking of this operation, that there is no necessity for scraping off the cartilage from the acetabulum of the joint, as is recommended by Mr. Bromfield ; for it is found, by experience, as I have observed in the last Section, that the teguments adhere to cartilages as readily as to bone.

SECTION XII.

Of Amputating the Arm.

THE general observations I have made upon the method of amputating the thigh and leg, apply equally to the amputation of the arm and fore-arm. At present, therefore, I shall only observe, that in amputating the arm, no more of it should be removed than is diseased ; for the longer the stump is, the more useful it proves ; and the same attention should be given to the saving of teguments for covering the fore that I have advised in amputating the leg. But it is proper to remark, that this may always be done both in the arm and fore-arm without the assistance of a flap : for there is in every part of both a sufficiency of muscles and cellular substance, for admitting of the fore being completely covered by amputating with the double incision, in the manner I have pointed out for this operation upon the thigh ; and wherever this can be done, it should be preferred to the method of operating with a flap.

CHAPTER XLV.

OF REMOVING THE ENDS OF BONES IN DISEASES OF THE JOINTS.

THE amputation of limbs is more frequently advised for diseases of the joints than for any other cause ; and as this often happens where the rest of the limb is sound, it were to be wished, that with safety and propriety we could remove such parts as are diseased, and leave those that are sound. In compound fractures and dislocations, the ends of large bones have frequently been sawn off, when such parts of them have protruded as could not be replaced. The deficiency thus produced, has in most instances been supplied by nature ; and thus the limbs have remained almost equally useful as before. In a few cases, too, of diseased joints, a cure has been obtained by the head of a bone being sawn off. Among other instances of this to be met with in books, a remarkable one is recorded by a very ingenious and expert surgeon, Mr. White of Manchester, who preserved an arm by sawing off the head of a diseased humerus.* But Mr. Park of Liverpool, was the first who ventured to propose it as a general remedy in affections of the joints.† Whether or not it will stand the test of experience, farther trials must determine ; but in the mean time, the public are much indebted to Mr. Park for the pains he has taken to introduce a less formidable remedy in place of amputation.

* Vide Cases in Surgery with Remarks, Part I. by Charles White, F. R. S. &c.

† Vide An account of a new method of treating diseases of the joints of the knee and elbow, by H. Park.

What Mr. Park proposes is, that instead of amputating a limb for any external violence done to a joint, for a white swelling, a caries, or any other affection, that the diseased ends of the bones should be sawn off; when nature, he thinks, will commonly supply the deficiency of bone; by which the limb will be preserved, and will prove more useful than any machine that artists can invent.

Mr. Park supposes that this operation will be chiefly applicable to affections of the knee and elbow, and more particularly to those of the latter; and he relates a case of white swelling of the knee in which it was practised with success: the under extremity of the femur and the upper end of the tibia were sawn off; no artery of importance was injured; and the vacancy produced by the removal of the ends of the bones was supplied with callus: in the course of ten weeks, a cure of the sore was obtained; the limb became so firm that the man has since been able to go to sea as a sailor, and he does not even use a crutch.

This, however, is the most favourable view of the proposal; and it is proper to remark, that in the course of the cure, much perplexity occurred from various circumstances; particularly from the difficulty of preserving the limb in a steady fixed situation; from the great depth of the wound; from the lodgment of matter; and from the formation of sinuses. By much attention on the part of Mr. Park, all these difficulties were surmounted; but although the merits of the operation must be determined by farther trials, yet the risk attending it appears to be so great, that there is much reason to think that it will never be generally practised.

For a more particular detail of the method of doing it, and of the after treatment of the sore, the publication itself must be consulted; but for the advantage of those who may not easily meet with it, the following short account of the operation is inserted in Mr. Park's own words,

“An incision was made, beginning about two inches above the upper end of the patella, and continued about as far below its under extremity: another, crossing this at right angles, immediately above the patella, the leg being in an extended state, was made through the tendons of the extensor muscles down to the bone, and nearly half round the limb; and the lower angles formed by these incisions were raised so as to lay bare the capsular ligament: the patella was then taken out, and the upper angles were raised, so as fairly to denude the head of the femur, and to enable me to pass a small catling across the posterior flat part of the bone immediately above the condyles, taking care to keep one of the flat sides of the point of the instrument quite close to the bone all the way. The catling being withdrawn, an elastic spatula was introduced in its place, to guard the soft parts while the femur was sawing through: which done, the head of the bone thus separated was carefully dissected out: the head of the tibia was then with ease turned out and sawn off, and as much as possible of the capsular ligament dissected away, leaving only the posterior part covering the vessels; which, on examining, I had the satisfaction to find had not only escaped unhurt, but that it was not a very narrow escape: they had still a pretty good covering, and had been, through the whole operation, far enough out of the course of the knife. It must be confessed, that the appearance of the wound was somewhat formidable, exhibiting a very large cavern with very thin parietes; and in short, there seemed little wanting to complete the amputation: yet as the limb below would not be deprived of any part of its nourishment, and as every healthy incised surface, as well of bone as of soft parts, has a natural tendency to granulate, I could not see any room to doubt, that nature would be able to repair the breach.”

Mr. Park afterwards informs us, that he attempted to perform the operation without making the trans-

verse incision : but he found it could not be done ; and after spending some time in the attempt, it was thought advisable to desist from it. More than two inches of the femur, and rather more than one inch of the tibia, were removed ; which were but just enough to admit of the leg being brought into a right line with the thigh, the previous contraction of the flexor muscles being such as to keep the two sawn ends of bone in close contact : this produced a considerable redundance of the teguments. To support this, that it might not fall inward, and to keep the edges of the incision in apposition till they should acquire some degree of firmness, a few stitches were passed through the skin ; not merely along the course of the transverse incision, but upon that of the longitudinal cut that extended up the thigh. The lightest superficial dressings only were applied, and the limb placed in a case of tin from the ankle to the insertion of the glutæus muscle.

Mr. Park very candidly enumerates several objections that may be made to this operation ; but, at the same time, he thinks that all of them may be obviated. There are two however, which in my opinion, will always appear with force against it : the first is, that where the bones of large joints are so much diseased as to render it necessary to remove them, the surrounding soft parts are commonly so much thickened, inflamed or ulcerated, as to render any attempt to save them very uncertain, and much more hazardous than the amputation of the limb : and the second is, the high degree of inflammation that commonly succeeds to wounds of the larger joints.

With respect to the first of these, Mr. Park himself wishes it to be understood, that it is chiefly in affections of the joints produced by external violence, that he thinks this operation will be peculiarly useful ; and with respect to the last, he observes, that the heads of large bones have been frequently sawn off, without any violent symptom taking place : and as he sup-

poses this to be owing to the very free division of the capsular ligaments, which in such cases must always happen, he thinks that the total removal of this ligament, which he advises in this operation, will in a great measure prevent it. I have observed above, that experience alone can determine upon the merits of this operation; but I cannot avoid remarking, that no necessity appears for the removal of any part of the capsular ligament. It may be highly proper to make the opening into it free and large; but to remove it, by dissecting it off from the contiguous parts, must probably add to the risk of the operation, by rendering the inflammation more severe than it otherwise might be; at the same time that it must necessarily render it much more painful as well as more tedious. Farther experience may perhaps, set this in a different point of view: but at present I see no more reason for removing any part of the capsular ligament in this operation, than for the removal of the tunica vaginalis testis in the operation for the hydrocele; a practice now altogether laid aside, even where the cyst is much thickened.

CHAPTER XLVI.

OF ISSUES.

ISSUES are small artificial ulcers that we form in different parts of the body, for the purpose of procuring a discharge of purulent matter.

As I have elsewhere treated fully of the advantages that may be derived from issues, and of the manner in which they seem to act in the cure of diseases, it is not at present necessary to enter minutely upon this part of the subject: I shall, therefore, only observe, in general, that I am daily more and more convinced of the utility of issues in the cure of long continued sores, of whatever kind they may be; and that I am still of the opinion that they act solely by discharging a certain quantity of the serous parts of the blood; and not that they serve merely as drains for noxious humours, which, till of late, has been the prevailing opinion of practitioners.*

Among other errors in practice to which this opinion gave rise, the choice of situation for issues was none of the least remarkable. As it was imagined that ulcers as well as other local diseases were produced by a determination of morbid humour to a particular spot, when issues were advised, it was considered as necessary to place them as contiguous to the affected part as possible, and always on the superior part of the limb when the disease was seated on any of the extremities, in order to prevent the morbid matter from falling down to it. But as we now conclude that issues prove useful or otherwise merely by the quantity

* See Chapter IV. on the Theory and Management of Ulcers, where this subject is fully considered.

of matter which they afford, it appears to be of little importance where they are placed ; and accordingly they may be inserted wherever the patient thinks they will occasion the least inconvenience.

Some general rules, however, should be observed in the introduction of issues : they should never be placed immediately above a bone thinly covered ; nor directly above a tendon ; nor very contiguous to a large blood vessel or nerve ; nor upon the belly of a muscle. The best situation for issues is that space which lies between the tendons on the back part of the neck, where there is a considerable depth of cellular substance ; the middle of the humerus, near to the insertion of the deltoid muscle ; and a considerable hollow above the flexor tendon on the inside of each knee. They may likewise be inserted between two of the ribs, and on each side of the vertebræ of the back ; or, in short, wherever there is a sufficient quantity of cellular substance for the protection of the parts beneath. It is proper, however, to remark, that the spot usually fixed upon for issues is perhaps the most improper of any, I mean directly below the knee ; where there is never much cellular substance ; where the veins of the leg can scarcely be avoided ; and where the peas are apt to hurt the contiguous tendons.

Issues may be formed in various ways : by corroding or removing the skin with epispastic applications ; by making an incision with a scalpel or lancet ; by the application of caustic ; and the introduction of a cord.

When an issue is to be opened by removing a portion of skin, a blister must be applied upon the spot, exactly of the size of the intended sore ; and on the blister being removed, a discharge of matter may be kept up, by dressing the part daily with any common ointment in which there is mixed a small proportion of cantharides in fine powder : or, it sometimes proves sufficient to use this irritating application, and a mild ointment of wax and oil alternately.

In forming an issue by incision, or with caustic, an opening must be made of such a size as is sufficient for affording a proper quantity of matter; and the aperture must be preserved by inserting daily into it some extraneous body covered with any mild digestive ointment, such as basilicon or linimentum arcæi, while the whole must be secured with a proper bandage. Peas are commonly employed for this purpose. Kidney beans answer very well; and some make use of gentian root, and of aurantia curassaventia, usually termed orange peas, turned into a proper form. When the opening is made by an incision, the skin should be supported on one side by an assistant, and on the other by the left hand of the surgeon; who should now, with a scalpel in the other, make a cut of a sufficient length and depth for receiving the number of peas intended to be put into it, and thus the operation is finished: but when done with caustic, more attention is requisite. Many compositions of caustic paste have been recommended; but I have met with none that for this purpose answers so well as the lapis infernalis or causticum commune of different Dispensatories. It should be first reduced to powder, and made into a paste with water, or with soft soap, when as much of it should be applied upon the spot where the issue is wanted as will make an opening of a proper size; but as it is apt to spread to the contiguous parts, some care is required to prevent it. For this purpose, a piece of leather spread with Burgundy pitch, or any adhesive plaster, with a small hole cut in the centre, should be placed upon the part, with the hole directly on the spot where the caustic is meant to be applied. The small spot thus left uncovered, must now be spread with the caustic paste; and over the whole there should be laid another piece of leather spread with the same adhesive plaster, so that no part of the caustic may escape. In the course of ten or twelve hours, the whole may be removed; for before this if the caustic

is good, it will have produced an eschar of a sufficient depth. In the space of three or four days, the eschar will separate from the contiguous sound parts, when the opening formed by it must be filled with peas or some other of the substances I have mentioned. .

When it is necessary to discharge a large quantity of matter by an issue, and especially when we wish to have it from deep seated parts, we do it by the introduction of a cord of cotton or silk, forming what is commonly termed a seton. This we often employ with advantage in deep seated pains, particularly in pains of the breast and sides in phthisis pulmonalis. In such cases it is commonly inserted between two of the ribs; and it answers better in the direction of the ribs than when placed across them, as is sometimes done. A cord is also a frequent remedy in diseases of the head, particularly in ophthalmia and other affections of the eyes; and in such cases it is usually placed in the back part of the neck.

In the introduction of a cord, the parts at which it is to enter and pass out, should be previously marked with ink; and the cotton or silk being put into the eye of the flat needle, Plate LIV. fig. 5. and the parts supported by an assistant, the needle should now be pushed in at one of the spots and carried out at the other, along with two or three inches of the cord, which should be left hanging out. The irritation which the cord excites is soon followed by a plentiful discharge of matter, which may be increased or diminished at pleasure, by covering the cord daily, before it is drawn, with a mild or an irritating ointment.

In former times, it was a frequent practice to form issues by burning the parts into which they were to be introduced with the actual cautery; and in some parts of Europe it is still continued: but as it is much more terrifying than any of those that I have mentioned, and as it does not appear to be attended with any particular advantage, it is now in general laid aside.

In China, Japan, and some other eastern countries, it is still a prevailing practice, in deep seated pains, to burn the parts affected down to the bone with moxa. Moxa is a light, soft combustible down, of a particular plant. A small cone of it being wrapped up, the base of the cone is fixed upon the part with glue or mucilage; and fire being put to the opposite end of it, it is allowed to remain till the whole is consumed; and if one application does not prove sufficient, it is repeated once and again as long as it is necessary. The operation may be done equally well with fine flax; but although it has been sometimes done in different parts of Europe, it will not probably be ever generally practised. I have known it, however, remove the most obstinate sciatic pains, where every other remedy had failed.

CHAPTER XLVII.

OF THE INOCULATION OF THE SMALLPOX.

THERE is cause to imagine, that almost all eruptive diseases, as well as some others, may be communicated by inoculation: the practice, however, is confined to such as are not apt to return; for no advantage would arise from inducing diseases to which the system might afterwards be liable. The plague has been communicated by inoculation; but in this country the smallpox, and of late the cow pox, are the only diseases that we are accustomed to inoculate. Some trials have indeed been made for inoculating the measles; but as yet they have not succeeded.

From the result of some experiments, there is reason to think, that no disease can be communicated by inoculating with the blood of an infected person. This, however, is not as yet precisely determined; so that farther trials will be necessary to ascertain it. In inoculating the smallpox and cow pox, we employ the matter contained in the pustules.

The proper period for inoculating, the preparation of the patient, and the subsequent treatment of the disease, are points that more particularly fall to the consideration of the physician. The mode of communicating the infection is our only object at present.

In the more early practice of inoculation, it was customary to tie an infected thread round the arm or leg; to rub a little variolous matter upon any part of the body; or to insert a piece of thread soaked in matter beneath the cuticle, with a small needle, and to allow it to remain till there was reason to think that the infection had taken place. In any of these

ways the disease may be communicated : but as by some of them there is cause to suspect that a variolous atmosphere may be produced, and that the disease may be thus induced in the same way as in the case of a common contagion, and consequently that some of the advantages of inoculation may not be obtained from them, these modes of giving the smallpox ought therefore to be laid aside.

Till of late, inoculation was commonly performed by making an incision of about half an inch in length through the skin to the depth of the cellular substance : a bit of thread impregnated with variolous matter was then inserted, and retained for two or three days with a compress and bandage. To this practice, however, the great unnecessary pain attending it, and the aptness of the wound to degenerate into a disagreeable ulcer, are strong objections.

The present mode of inserting the matter appears to be in every respect more eligible. The point of a lancet, previously covered with variolous or vaccine matter, is insinuated through the cuticle so as to scratch or slightly injure the cutis vera. It might frequently indeed be sufficient to pass it through the cuticle only ; but we do not so readily fail when a small particle of blood follows the lancet. When the matter is recently taken in an early period of the disease, the lancet may be introduced without being moistened ; but whenever the matter has become firm and hard, it should be rendered soft with a drop of warm water, or by holding it in warm steam.

The operation may be done in any part of the body ; but the arm is generally preferred. One scratch would for the most part prove sufficient ; but with a view to ensure success, two or even three are commonly made at the distance of an inch from each other. It is to be observed, however, that when the matter takes effect in all the scratches, the inflammation that ensues being communicated from one to the oth-

er, is often considerable, and gives much pain and uneasiness. This is easily prevented by making only one scratch in each arm, which for several years past I have uniformly done.

In this method of inoculating, we never employ either bandage or comprefs; for the wound is so trifling that no kind of dressing is necessary: so that we readily see, at the end of a few days, whether the infection will take place or not; for in general, by the third or fourth day, if the operation is to succeed, the scratches made with the lancet become red, swelled, and somewhat painful.

CHAPTER XLVIII.

OF PREVENTING OR DIMINISHING PAIN IN CHIRURGICAL OPERATIONS.

TO be able to alleviate the misery of those who are obliged to submit to dangerous operations, must afford the highest gratification to every practitioner : and as pain is the most dreadful part of every operation, it necessarily demands our most serious attention.

The pain induced by operations may be lessened in different ways : by diminishing the sensibility of the system ; and by compressing the nerves that supply the parts upon which the operation is to be performed.

Narcotics of every kind might be employed for the purpose of lessening general sensibility ; but nothing answers this with such certainty and effect as opium.

But as opiates, when given in doses large enough for this purpose, are apt to induce sickness and vomiting, I seldom venture on giving them before an operation, unless the patient has previously been in the habit of using them. In general they prove most useful when given immediately after, when they very commonly alleviate that pungent soreness of which patients at this time usually complain ; and by continuing to give them in adequate doses from time to time, we are often enabled to keep the patient easy, till relief is obtained by the formation of matter, or by the removal of that inflammatory tension that usually takes place after every capital operation : and as this proves

not only highly comfortable to the patient, but tends in the most effectual manner to moderate the febrile symptoms that commonly occur, it should never be omitted.

It has long been known, that the sensibility of any part may not only be lessened, but even altogether suspended, by compressing the nerves that supply it: and accordingly, in amputating limbs, patients frequently desire the tourniquet to be firmly screwed, from finding that it tends to diminish the pain of the operation.

The effect of this, however, being inconsiderable, it has lately been proposed by Mr. James Moore, of London, to compress the principal nerves so completely as to render the parts beneath altogether insensible. In Plate XCIX. an instrument is delineated, by which this may be very effectually done.

Whether or not it will answer with ease and certainty, experience alone must determine: but, in the mean time, we are much indebted to the ingenious author, for affording a hint that eventually may tend to mitigate the sufferings of those whom necessity obliges to submit to chirurgical operations. All that this instrument seems to require in order to render it perfect, is the power of compressing the nerves of a limb without affecting the veins; for as it is found that the nerves must be compressed for a considerable time, at least an hour, before the parts beneath are rendered altogether insensible, the veins could not be compressed for such a length of time but with the risk of bursting. With a view to prevent such a disagreeable occurrence, Mr. Moore proposes that one of the veins in the limb should be opened. But as this might prove hurtful to weakly patients, in whom it is often of importance to guard against the loss of blood, it would be better to avoid it, by having the instrument formed in such a manner, that it might compress the principal nerves only, without materially affecting the

veins. This will not indeed be easily done, as the nerves usually run at no great distance from the veins : but the same purpose may perhaps be answered by compressing the arteries of the limb for a minute or two before any pressure is applied to the veins ; by which the latter may be previously emptied.

CHAPTER XLIX.

OF MIDWIFERY.

SECTION I.

General Observations on Midwifery.

MIDWIFERY being now considered as a distinct branch of chirurgical practice, a minute account of it will not be expected in a System of Surgery. For more particular information, those authors who have written upon it may be consulted : but I have judged it proper to delineate the instruments usually employed in midwifery ; and to describe two operations, which, although immediately connected with this branch, are yet more frequently performed by the surgeon than the accoucheur ; namely, the Cæsarean operation, and the division of the symphysis pubis.

A great variety of instruments have been invented by practitioners in midwifery ; almost every publication, indeed, upon this subject, announces some new invention. It is only those instruments, however, which experience has shown to be useful, that I mean to describe : they are not numerous ; and are all delineated in Plates CII. CIII. CIV. CV. and CVI.

With the forceps in Plate CII. fig. 2. we lay hold of the head of the child when the mother is much enfeebled and the contraction of the uterus not sufficient to expel the child in the usual way : and when delivery cannot be effected even in this manner, or by turning the child, and bringing it away by the feet, as sometimes happens from the pelvis being much distorted, we employ the crotchet represented in Plate

CIII. fig. 3. for bringing the child away piecemeal, after lessening the size of the head by an opening made in the skull for discharging the brain with the scissars represented in fig. 1. of the same Plate.

The necessity, however, of using any of these instruments I believe to be exceeding rare : they are indeed frequently employed ; but this proceeds in a great measure from impatience on the part of practitioners, who often force the delivery of the child, when nature, if left to herself, would effect it in a much more easy manner. This fact is so certainly well founded, and is of such general importance, that practitioners of every description, and more especially those who are newly entering on business, should never lose sight of it. By not meeting with that attention which it merits, both the forceps and crotchet are daily employed with too much freedom, to the disgrace of the art, and often with irreparable injury both to the mother and child.

In some cases it happens, that delivery cannot be accomplished even with the assistance of these instruments, owing to the brim of the pelvis being so narrow that it will not allow any part of the child to pass. In such circumstances, the Cæsarean section, as it is termed, used formerly to be practised ; but the danger attending that operation being so great that the mother was seldom saved by it, Mr. Sigault of Paris, about four and twenty years ago, proposed the division of the symphysis pubis, for the purpose of increasing the diameter of the pelvis, and for extracting the child in the usual way, by the vagina.

SECTION II.

Of the Cæsarean Operation.

THIS operation may become necessary, as we have seen in the last section, by the brim of the pelvis being so narrow that it will not allow the child to pass ; and it may also become proper where the child has been forced into the cavity of the abdomen by a rupture in the uterus, as sometimes happens from the uterus contracting with too much force before the os tinæ is sufficiently dilated.

The Cæsarean section may be performed, either with a view to save both the mother and child, when the child cannot be extracted in any other manner ; to save the mother only when we know that the child is dead ; or to save the child immediately after the death of the mother.

As there are few instances of the mother being saved by this operation, some have advised that it should never be performed till after the death of the mother. I am clearly of opinion, that an operation attended with so much hazard, should never be advised as long as there is the least reason to hope that delivery may be effected in any other manner : but I also think, that it is the duty of every practitioner to propose it when this cannot be accomplished ; for it is surely better to afford the small chance to the mother that accrues from it, than to leave her with the certain prospect of death ; while by the same means we may be enabled to save the child, which otherwise would be destroyed. None will hesitate in advising it after the death of the mother, when the child is found to be living. The following is the method of performing it.

The patient should be placed upon a table of the usual height, and laid upon her back ; her hands and

legs being properly secured by assistants ; her head should be moderately elevated with pillows, and her thighs somewhat raised, in order to relax the abdominal muscles. The operator standing on one side of the table, is, with a common round edged scalpel, to make an incision, six inches in length, through the skin and cellular substance, on one side of the abdomen : the cut should commence two inches above the umbilicus on the outer edge of the rectus muscle, and from thence should be carried in a perpendicular direction six inches downwards. The uterus is now to be laid bare, by carrying the incision through the tendinous parts of the abdominal muscles, and peritonæum ; and this being done, an opening of the same length must be made in the uterus itself. The easiest method of effecting this, is, to make a small opening with the scalpel, sufficient to admit the finger, to serve as a conductor to a probe pointed bistoury, with which the remaining part of the incision should be finished. I may also remark, that the bistoury inserted upon the finger, at an opening made for the purpose, affords the easiest method of dividing the peritonæum and tendinous aponeurosis of the abdominal muscles.

If any large blood vessel is cut either in making the outward incision or in dividing the uterus, it should be immediately tied with a ligature of a sufficient length to hang out at the wound. The child must now be taken out ; the placenta, and any effused blood that may have escaped during the operation, being also removed, and the intestines, if they have protruded, being replaced, the external opening should be secured with three or four futures, in the manner I have advised in Chapter III. Sect. XII. § 3.

The wound being covered with a pledget of any emollient ointment, the abdomen should be supported with several turns of a broad flannel roller ; when the patient should be carried to bed, and strictly enjoined to avoid speaking and every kind of exertion.

Various causes concur to render this a very dangerous operation : of these, the extensive exposure of the abdominal viscera, and hemorrhagies from the uterus, are the most material. Any protrusion, therefore, which occurs of the bowels, should be immediately replaced, and no vessel of any importance that may be cut in the division of the uterus should be left untied : this is not advised by writers upon this subject, but I see no harm that can ensue from it. If the ligatures are applied with the tenaculum, they will soon separate ; and by hanging out at the external wound, they may at any time be pulled away. It may be remarked, that it is internal hemorrhagies only that we have to dread, I mean such as occur from the vessels of the uterus : for, by carrying the incision on the outer edge of the rectus muscle, we avoid the epigastric artery, the only vessel of importance that runs any risk of being hurt in the division of the teguments and muscles.

In order to avoid the risk of hemorrhagies from the uterus, some have advised the incision never to be made at that part where the placenta adheres ; while, by others, we are directed to make the opening into the uterus exactly in a longitudinal direction, by which we are told that the principal vessels with which it is supplied will most readily be avoided. No advantage, however, is derived from this : for the incision in the uterus must correspond exactly with the external incision ; which cannot with propriety be made in any other direction than the one I have mentioned. Besides, it would often be impossible to distinguish the part at which the placenta adheres ; nor is there much ground to suppose that the hemorrhagy from the uterus depends so much upon the direction as on the extent of the incision ; and it ought not to be less than six inches in length, as the child could not be extracted with freedom at a smaller opening. It is scarcely necessary to remark, that the child and placenta should be removed as soon after the incision

is made in the uterus as possible. It is thus allowed to contract, which it does instantaneously with great force ; by which the hemorrhagy is more readily stopped than by any means that we could employ for it.

By others, we are advifed to leave a large opening at the under part of the external incision, in order to give vent to any effufion of blood that may happen. No advantage, however, is gained by this, as the incision in the uterus, although oppofite to the external opening at firft, very foon falls beneath it when it contracts ; by which any blood that is difcharged falls into the bottom of the abdomen where it coagulates, and thus cannot be difcharged at the wound. And as it is of importance to prevent the air as much as poffible from finding accefs to the abdomen, the external cut fhould be quickly and entirely fhut, by as many futures as the length of it requires. The moft effectual method with which I am acquainted of preventing hemorrhagies is, the tying of any large veffels in the manner I have mentioned ; keeping the patient cool and free from pain, by regulating the air of the apartment to a proper temperature, and adminiftering opiates ; and by preventing, as I have obferved above, every kind of bodily exertion.

SECTION III.

Of the Divifion of the Symphyfis Pubis.

IT has been long known, that the bones of the female pelvis are connected in fuch a manner, that during the latter months of pregnancy, and efpecially during labour, they are feparated in fome degree from each other ; by which the paffage of the child is rendered much eafier than it otherwife would be. It was a knowledge of this fact, and the great danger

attending the Cæsarean operation, that first suggested the idea of dividing the bones of the pubis at their junction with each other in cases of narrow pelvis. It was proposed upwards of two hundred years ago, by a French surgeon of the name of Pineau ; but Mr. Sigault of Paris was the first who had the merit of putting it in practice, in the year 1777.

The operation is easily performed. The patient must be laid upon her back on a table of a convenient height ; the pelvis should be elevated with two or three pillows put beneath it, and the legs and arms secured by assistants. When in this situation, the bladder must be emptied by the introduction of a catheter, which should be retained in the urethra by one of the assistants till the division of the bones is completed.

After shaving the pubis, the operator, standing on one side of the patient, should, with a longitudinal incision, divide the skin and cellular substance covering the pubes at their symphysis : the cut ought to commence at the upper edge of these bones, and be continued nearly, but not entirely, along their whole breadth : on the bones being laid bare, the cartilage by which they are joined must be slowly and cautiously divided ; and as it is by no means hard, it is easily done. Both the teguments and cartilage, may be divided with a firm round edged scalpel of the common form, which is the only instrument except the catheter that is necessary in this operation. The intention of the catheter is, to point out the course of the urethra to the operator ; for it lies so contiguous to the pubes at their symphysis, as to be in great danger of being cut, if this precaution is neglected : even the bladder itself might be injured, were the division of the cartilage not conducted with caution ; but with due attention to these points, and avoiding the total division of the soft parts at the under edge of the bones, all risk of hurting either the bladder or urethra may be prevented.

On the division of the cartilage being completed, the bones recede considerably from each other. To prevent any consequences that might ensue from their separating forcibly and suddenly, the assistants who have the charge of the thighs should be desired to support them, particularly towards the end of the operation; and if a sufficient opening is not gained in this manner, the thighs may afterwards be slowly and gradually separated.

The child is now to be delivered in the usual way by the vagina; and this being effected, and the placenta removed, the bones should be immediately put together, and retained as exactly as possible in their situation, by the proper application of a flannel or cotton roller round the pelvis and thighs; at the same time that the patient should be desired to remain as much as possible in one posture. The fore does not require any particular attention: in general, it heals easily with light mild dressings; and for the most part the union of the bones is completed in the course of the fifth or sixth week. The patient, however, should not be allowed to walk, or to put the body into any posture that might alter the situation of the bones, till nine or ten weeks have elapsed.

The chief objection that occurs to this operation is, the small space that is gained by it in that part of the pelvis where space is most required. By separating the ossa pubis at their symphysis, these bones do indeed recede to a considerable distance from each other: for the most part the separation that takes place will be at least two inches in length; but this does not increase the narrow diameter of the pelvis, that is, the bones of the pubis will still remain at nearly the same distance from the os sacrum as before the operation; and in almost every instance of difficult labour from malconformation of the pelvis, we find that it proceeds entirely from the ossa pubis and os sacrum being too near each other. It may often happen, however, that the head of the child may be so situa-

ted, that even this separation of the ossa pubis alone may allow it to pass, when otherwise it would have remained entirely above the brim of the pelvis ; and as we do not find that the operation is productive of much danger, for in different instances it has been done more than once on the same person, it should always be advised, when we are convinced that the pelvis is so narrow that the child cannot possibly pass through it. It should always be advised in preference to the Cæsarean operation.

If farther experience shall show, that in all cases of narrow pelvis, the child may be delivered in this manner, it should even be preferred to the mode of delivering with the crotchet, which is undoubtedly one of the most barbarous operations in surgery ; for while the very intention of the operation is to destroy the child, it often tears and mangles the mother so much that she never recovers from the effects of it.

CHAPTER L.

OF OPENING DEAD BODIES.

WITH a view to discover the seat and causes of diseases, and at the instance of the civil magistrate in cases of violent death, surgeons are employed to open dead bodies ; and to do this with accuracy, every preternatural appearance should be committed to paper. After noting any external marks of disease, we proceed to examine the state of the different cavities and of their contents. When the disease has been evidently seated in one cavity, we do not open the others ; but when they are all to be examined, it is proper to begin with the head.

The body being placed upon a table of a convenient height, and the head firmly fixed by an assistant, an incision should be made from ear to ear across the parietal bones. The scalp is now to be dissected from the parts beneath ; and one half being turned backward and the other over the face, a common amputating saw is used for dividing the cranium : the division may be begun on the os frontis immediately above the frontal sinuses, and should afterwards be continued backward through the parietal bones and os occipitis. The upper part of the skull is now to be raised with a levator ; by which the dura mater may be freely examined ; and if we wish to go to the depth of the ventricles only, this may be done without removing the brain. But when our object is to examine the state of the brain and cerebellum, they must both be removed and examined at leisure. This being done, and all the extravasated blood taken off with a sponge, the brain and cerebellum, must be replaced with the skull cap above them. The two portions of scalp are now

to be drawn over the whole, and secured in their situation by sewing the edges of the cut together from one end to the other, either with the glover's stitch, or in any other way which the operator may prefer. For this purpose narrow tape is usually employed, and a large curved needle with a triangular point.

The cavities of the thorax and abdomen are most effectually exposed in the following manner: let an incision be made through the common teguments from the top of the sternum to the umbilicus, and let it be continued on each side through the abdominal muscles, from the umbilicus in an oblique direction down to the top of the os ileum: the teguments and muscles must now be dissected from the thorax, till all the cartilages which connect the sternum and ribs are freely laid bare; and being drawn backward, the cartilages must be divided with a strong knife as near as possible to the ribs; when the diaphragm being separated beneath, the under part of the sternum and cartilages connected with it, being raised and turned upward, the sternum must either be separated from the clavicles, or cut across near to the upper end of it. In this manner the contents of the thorax and abdomen are brought into view, when most of them may be examined without being removed; but when more accuracy is required than this admits of, the whole should be taken out: or, when a partial examination is only required, that portion of them only may be removed which we mean to inspect.

To prevent the inconvenience resulting from the infusion of much blood and excrement, two strong ligatures should be passed at the distance of an inch from each other round the under part of the alimentary canal and large contiguous blood vessels, and round the trachea, œsophagus, and large blood vessels of the neck. The parts between the two ligatures both above and below being divided, the whole viscera of both the cavities may then be easily removed by dis-

fecting them from the contiguous parts, and raising them up as we go along.

The necessary examination being finished, the effused blood all washed off with a sponge, and the viscera replaced, the teguments must be drawn over them, and stitched together with as much neatness as possible.

'In opening bodies that have died of any disease, the operator should be as cautious as possible in avoiding cuts or scratches of his fingers and hands: various instances have occurred of much distress being induced; and in some cases even death has ensued, from inattention to this circumstance.

CHAPTER LI.

OF EMBALMING.

IN former times, embalming was practised with more care and attention than it is now. This was a necessary consequence of the desire which then prevailed, of preserving dead bodies for ages. At present it is seldom employed, except for the purpose of preventing bodies from putrefying, during the short space which elapses between the death and burial of the person; and not even with this view, if the corpse be not to be kept longer than is usually done in private life. The following is the present method of embalming. The brain, and all the viscera of the thorax and abdomen, being removed in the manner I mentioned in the last Chapter, they are all, excepting the heart, put into a leaden box with a considerable quantity of an aromatic antiseptic powder, prepared with myrrh, frankincense, cloves, the leaves of lavender, rosemary, mint, sage, and other similar articles; and to these are added a proportion of any odoriferous oils. The blood being removed from the different cavities, and the heart replaced, they are all filled with the same kind of powder, with a due proportion of odoriferous oils or spirits, and the parts afterwards sewed up in the manner I have already advised. By some, too, the mouth and nostrils are stuffed with these powders and oils; and incisions are made into all the fleshy parts of the body, which are also stuffed with them, and afterwards sewed up: but there is no necessity for this, unless the body is to be kept for a great length of time, or to be carried to a considerable distance. In which case, it is usual, after stuffing the incisions in the man-

ner I have mentioned, to roll all the extremities, as well as the trunk of the body, firmly and separately up with bandages, and to cover the whole with varnish.

The body is now to be laid upon a cerecloth of a sufficient size, which must be applied with as much neatness as possible to the head and every part of the body, and either firmly secured by sewing, or with tapes tied at proper distances. The cerecloth is made of linen dipped in a composition of wax, oil, and resin; which should be of such a consistence as to be sufficiently pliable, without being so soft as to stick to the fingers of those who apply it: it may be coloured with verdgris, red lead, or any other article, according to the fancy of the operator. When two cerecloths are applied, one above another, they are usually made of different colours.

The cerecloth being put on, it was formerly the custom to employ a painter to colour the face; but this is now very commonly omitted: the dress intended for the corpse is immediately put on; and the body is either laid in the coffin, or allowed to be exposed, according to circumstances.

CHAPTER LII.

OF BANDAGES.

BANDAGES are employed for various purposes in surgery ; for the retention of dressings ; for stopping hemorrhagies ; for removing deformities ; and for effecting the union of divided parts.

As a proper application of bandages is an object of much importance, it is a branch of the art which authors have not neglected : many treatises have been published upon it ; but unfortunately it cannot be taught by description : experience alone can give an adequate idea of it ; nor is it possible to acquire it but by much manual practice. Hence, in the study of this part of surgery, more advantage is to be gained by practising upon a block, than by reading the most elaborate dissertations. My only intention, therefore, at present is, to offer a few general observations upon bandages.

1. Bandages should be formed of such materials as are sufficiently firm for effecting the purpose for which they are intended, at the same time that they may fit with ease upon the parts to which they are applied.

In some cases a degree of firmness is required, which cannot be obtained from materials of a soft texture : of this we have examples in the most part of trusses for herniæ, as well as in every bandage requiring much elasticity : but for the most part bandages are made of linen, cotton, or flannel. Till of late, linen was universally used for this purpose ; but later experience has shown, that cotton and flannel are preferable. They absorb moisture more readily, whether it be produced by sweat, or as the ordinary discharge of wounds or

fores, at the same time that they are better calculated by their elasticity for yielding to the swelling which often takes place in luxations, fractures, and other injuries for which bandages are employed. Flannel was first used for this purpose in the Royal Infirmary here, about forty years ago, by Mr. James Rae of this place; and since that period the practice has been generally adopted. The objection made to the use of flannel for bandages, by some practitioners, of its not being so cleanly as linen, is frivolous: neither of them will be cleanly if not frequently changed, while either of them will be sufficiently so, if this point is attended to.

2. Bandages should be applied of a degree of tightness sufficient for answering the purpose for which they are intended, without incurring any risk of impeding the circulation, or doing harm in any other manner. No advantage will accrue from them, if they be not sufficiently tight to support the parts affected; while swelling, inflammation, and even gangrene, will occur if they are too tightly applied.

3. Every bandage should be applied in such a manner, that it may be as easily loosened, and the parts examined with as much accuracy as possible. Thus in fractures of the thigh and leg, where the limb cannot with propriety be frequently raised, we now prefer universally the bandage with twelve or eighteen tails to the common roller. The former can be undone and fixed at pleasure without moving the limb, while a roller can neither be applied nor removed without raising every part of the limb to a considerable height.

4. Bandages should always be laid aside as soon as the purpose for which they are intended is accomplished. This being obtained, no advantage can accrue from them, and they often do harm by impeding the growth of the parts upon which they are applied.

5. I have found it necessary in the course of this work to mention bandages for many parts of the body. In speaking farther of bandages for particular parts I

shall begin with the head, and proceed downwards to the trunk of the body and extremities.

One of the best bandages for all the upper and back parts of the head, for the forehead, ears, and temples, is a night cap, with one band to tie it before, and another beneath the chin, as is represented in Plate CVII. fig. 1. The *couvre-chef* of the French, represented in fig. 2. is most frequently used for these parts; but it can neither be applied with such firmness or neatness as the night cap.

For the purpose of making compression on any particular part of the head, the radiated bandage, as it is termed, may be employed, as is represented in the same Plate, fig. 3. It may also be used for compressing the temporal artery: but for this purpose, the spring bandage represented in Plate LXIV. fig. 3. answers better.

In longitudinal cuts of the head, the uniting bandage, as it is termed, is used with advantage. It is formed of a long roller with two heads, with a slit or opening in the middle, as is represented in Plate CVIII. fig. 3. The sides of the cut being drawn neatly together, and covered with a pledget of any simple ointment, the cure is to be effected by means of this bandage, applied in the manner represented in fig. 6. of the same Plate. In cuts of this description, their edges may sometimes be retained together with sufficient exactness by this bandage; and, when this can be done, it should always be preferred to the mode of doing it with futures.

When it is necessary to retain dressings upon the eyes, it has usually been done by placing a compress over them and retaining it by several turns of a long roller, such as is represented in Plate CVIII. figure 1. This bandage, when employed for one eye, is the *monoculus* of authors, and it is termed *binoculus* when applied to both eyes. But as a roller passed round the head is apt to slip, even when applied in the most exact manner, the *couvre-chef* in Plate CVII.

figure 2. or the night-cap in the same Plate, figure 1. should be preferred.

In fractures and cuts of the nose, the dressings are best retained by a proper application of the uniting bandage in Plate CVIII. fig. 3. and a proper application of the same bandage answers best in longitudinal cuts of either of the lips.

In fractures of the lower jaw, we employ a four headed roller, such as is represented in Plate CVIII. fig. 4. The space left entire between the four heads is applied to the chin, the hole in the centre being meant to receive the apex of the chin. The two superior heads are then carried backwards; and being made to pass each other at the occiput, they are afterwards brought forward over the os frontis: they may either be fixed there, or again reflected back, and fixed with pins on the sides or back parts of the head. The two under heads of the roller being reflected over the chin, are then to be turned upwards, and either tied or pinned on the top of the head; or before fixing them, they may be made to pass each other two or three times. Various other bandages are described by authors for the head; but those I have mentioned, with a proper application of the common roller, Plate CVIII. fig. 1. for particular purposes, are all that can be ever required.

6. In Plate XCII. fig. 1. an instrument is delineated for one of the most material operations upon the neck, bronchotomy; and in Plate LIV. fig. 1. another is represented for the wry neck: a common roller may be made to answer every other purpose that can be required of a bandage in any part of the neck.

7. A variety of bandages are used for the shoulders and contiguous parts, particularly for fractures of the scapula, and fractures and luxations of the clavicle. In fractures of the scapula, a proper application of a long roller may, in most instances, prove useful; but in Chapter XXXIX. Section V. I have shown, that no utility is derived from bandages in fractures of the

clavicles : they cannot be applied with such tightness as to compress the fractured bone without impeding respiration ; and besides, we do not find that they are necessary, when the arm of the affected side is properly supported by the sling, Plate XCVI. fig. 2.

The most useful of all bandages for the thorax and abdomen, at least for the retention of dressings on any of these parts, is that which we usually term the napkin and scapulary, represented in Plate CIX. figure 1. That part of it which goes round the body A, is termed the napkin. When applied for making pressure upon a fractured rib, it should be in the form of a roller, and should pass two or three times round the body : when only used for retaining dressings, it should not go more than once round : it should be six or seven inches broad for an adult ; and secured by pieces of tape, tying it at each end, instead of pins. The scapulary B C, consists of a slip of linen, cotton, or flannel, about three inches broad, and of a length sufficient to reach from the upper part of the napkin behind, to pass over the shoulders and be pinned to it before : it is sometimes made with a hole in the centre for passing over the head ; but it answers better to divide the anterior end of it by a longitudinal slit into two, and in applying it, to make one of these slips pass on each side of the neck.

This bandage answers the purpose better than any other, for making pressure on the parts at which the viscera protrude, in umbilical and ventral herniæ. As in such cases it is a point of much importance to have the bandage firmly fixed, we not only employ the scapulary for preventing it from slipping down, but a strap connected with it behind is passed between the thighs, and pinned to it before, to prevent it from slipping up.

In Plate XCI. fig. 2. a bandage is represented for compressing the abdomen in the operation of tapping ; and in Plate LXV. different bandages are delineated,

or trusses, as they are termed, for the retention of the protruded viscera in cases of hernia.

9. As it is of much importance in various diseases, as well as in several operations, to have the scrotum properly supported, I have delineated some bandages for this purpose in Plate CX. The best bandage for the penis is a pouch, or bag of linen or cotton, to be fixed by a roller, or two pieces of tape passed round the body.

The T bandage, as it is commonly termed, Plate CIX. figures 3. and 4. is usually employed for the retention of dressings about the anus and perineum, as well as for some disorders of the scrotum; but in the last, one or other of the suspensory bandages, represented in Plate CX. will for the most part be found preferable.

10. In compound fractures of the arm, fore-arm, or hand, where motion of the limb would prove hurtful, the twelve or eighteen tailed bandage is equally proper as in similar affections of the lower extremities; but in simple fractures, as well as in almost every other affection of these parts, we prefer a proper application of the roller.

11. I advised the uniting bandage for longitudinal cuts in the head; it answers equally well in wounds of a similar nature in every part of the extremities, as is represented in Plate CVIII. fig. 6.





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